

ENERGY SURVEY FOR THE UNITED STATES DISCIPLINARY BARRACKS (USDB)

**AT
FORT LEAVENWORTH, KANSAS**

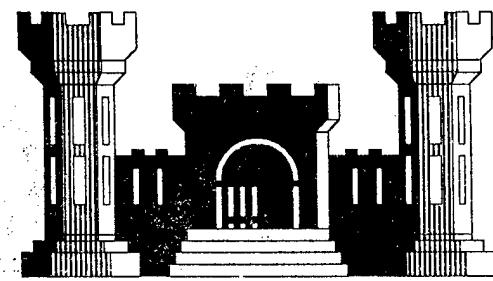
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ENERGY ENGINEERING ANALYSIS PROGRAM

CONTRACT NUMBER DACA41-89-C-D197

JUNE 25, 1990



**KANSAS CITY DISTRICT
CORPS OF ENGINEERS**

EXECUTIVE SUMMARY

C R B

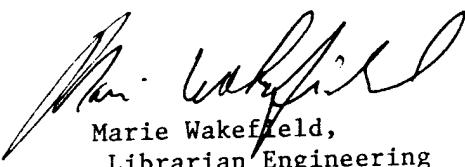


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Marie Wakefield,
Librarian Engineering

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INTRODUCTION

A. General Description

The United States Disciplinary Barracks (USDB) is located within the confines of Fort Leavenworth near Leavenworth, Kansas. Fort Leavenworth encompasses approximately 6000 acres of land in which approximately 2000 acres were developed for military use. The USDB is located to the northeast corner of the base.

B. Purpose of Report

The purpose of this report is to observe any present energy usage by the USDB and consider opportunities to conserve energy. The report details evaluation of various Energy Conservation Opportunities (ECO) to determine their feasibility.

The report also includes programming or implementation documentation for those ECO's considered feasible. Any ECO having a Savings to Investment Ratio (SIR) greater than one is considered feasible. If the ECO had a SIR greater than one and a simple payback less than 10 years it was considered for Energy Conservation Investment Program (ECIP) funding.

C. Observations

During our field trips to the USDB, we noted many observations relating equipment in disrepair. In general, little of the heating, ventilating, and air conditioning equipment appeared to have been maintained. Because of a lack of preventative maintenance throughout the USDB, a considerable amount of energy is being consumed with no appreciable contribution to the operation of the facility. The equipment controls are in need of maintenance the worst. A large portion of the control systems for the equipment were disconnected due to the lack of funding for repair. A preventative maintenance plan is currently under consideration at the USDB, but because of lack funding and proper personnel, the program could be in jeopardy.

LOGIC QUALITY INSPECTED 2

Some of the feasible ECO's described in this report will replace equipment that might not have been replaced if the original equipment had had preventative maintenance.

Some of the equipment was not in service because of a pending repair, thus no energy was used. The calculations completed with an estimate of what the equipment might use if it were operating.

D. Computer Programs

A number of different computer programs were used in the development of this report. To calculate the energy usage of each of the buildings, we used a program entitled "Trace Ultra" provided by the Trane Company. This program uses an hour by hour energy calculation routine as presented in Chapter 25 of the American Society of Heating, Refrigeration, and Air conditioning Engineers (ASHRAE) Handbook of Fundamentals. Simplified energy calculations were completed using an electronic spreadsheet. The "Life Cycle Cost in Design" (LCCID) Economic Analysis Computer Program, developed by the Government thru the University of Illinois, was used to calculate the life cycle cost estimates.

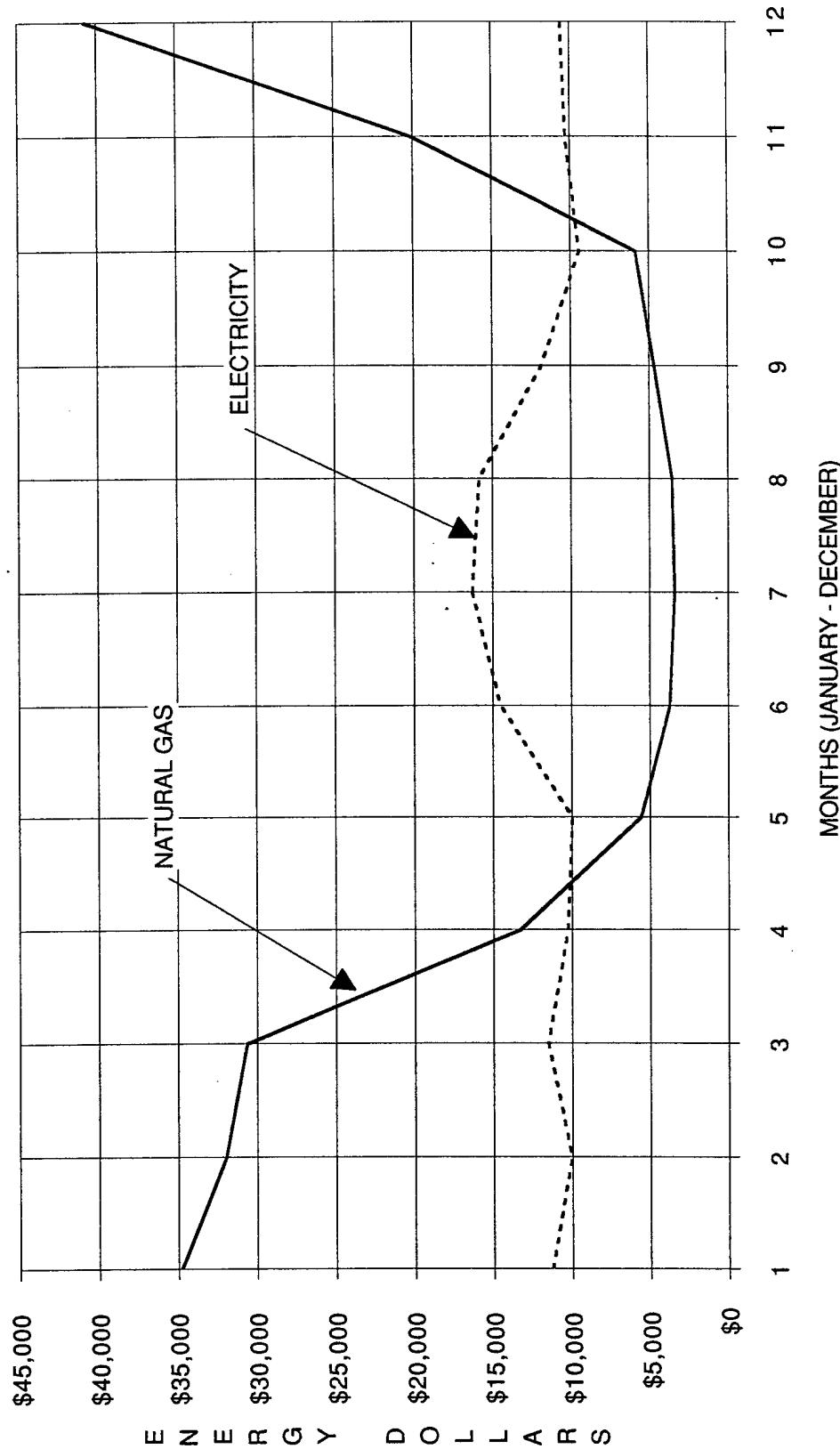
PRESENT ENERGY CONSUMPTION

General Description

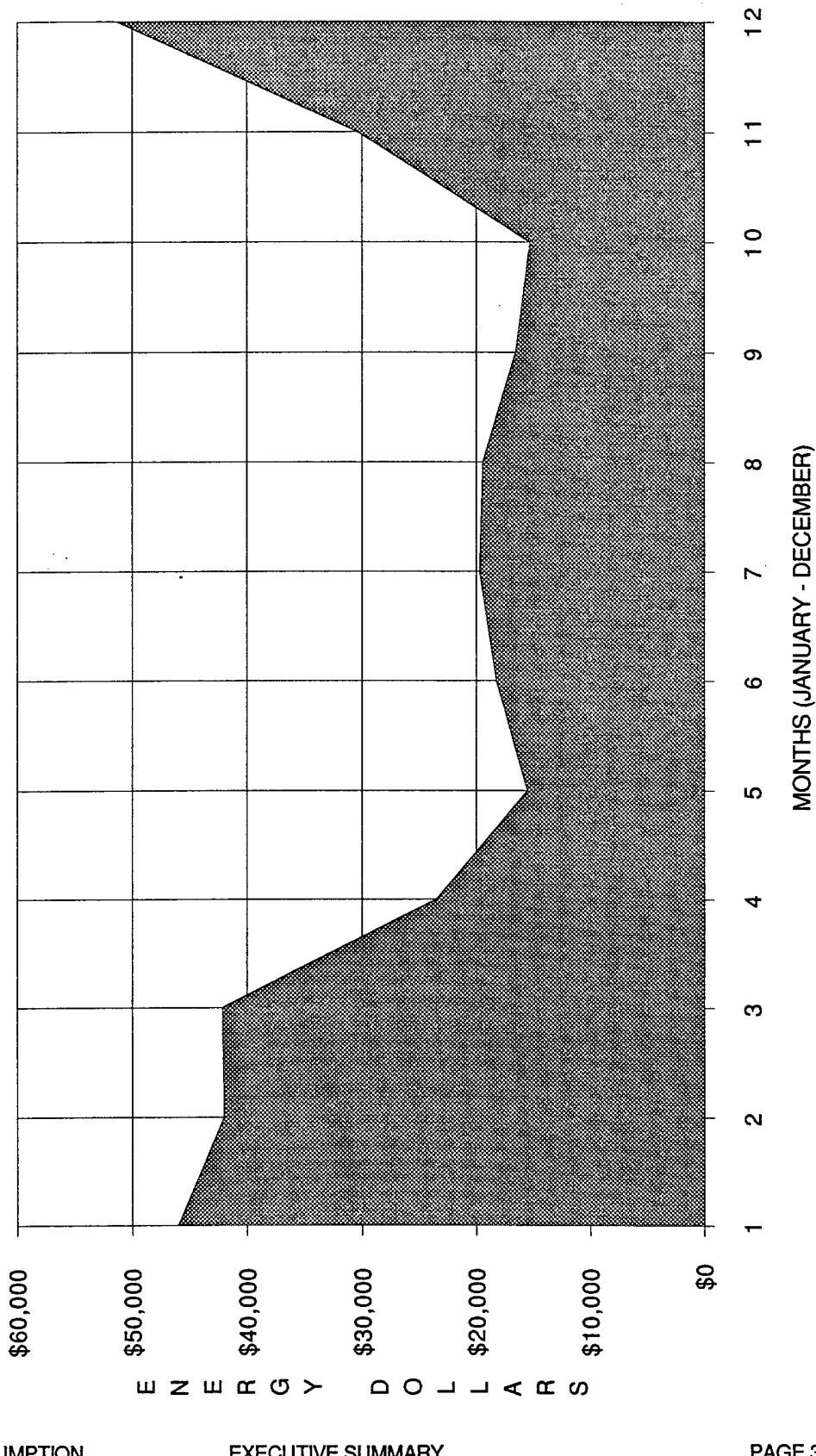
At the present time the energy usage associated with the United States Disciplinary Barracks (USDB) is in the form of three utilities. The first is electricity. The USDB uses electricity for all lighting, fan motors, and pump motors. The electricity used by the USDB is purchased from the electric utility for the area, Kansas Power and Light (KPL). The second utility used by the USDB is natural gas. Natural gas is used to fire the boilers in the boiler plant in the north section of the USDB. The boilers produce steam to be used in converters to make domestic hot water and in air handling unit coils for heating the spaces. The natural gas used to fire the boilers is purchased from the local gas utility Kansas Power and Light (KPL). Water is the third utility used in the USDB. The water is consumed in several different ways but in larger quantities by the inmate restrooms and showers. Water is purchased from a water plant owned and operated by Fort Leavenworth located on the grounds of the fort.

The following pages display the energy consumed per building studied and an overall energy consumption. Several buildings located in the USDB were not included in the scope of work to be studied. Therefore the overall energy usage would not be a total for the entire USDB. The energy usage included on the following pages is for the electrical and natural gas utilities. These energy usage amounts were calculated for each of the buildings. The USDB does not have metering available to check the amount of energy actually used.

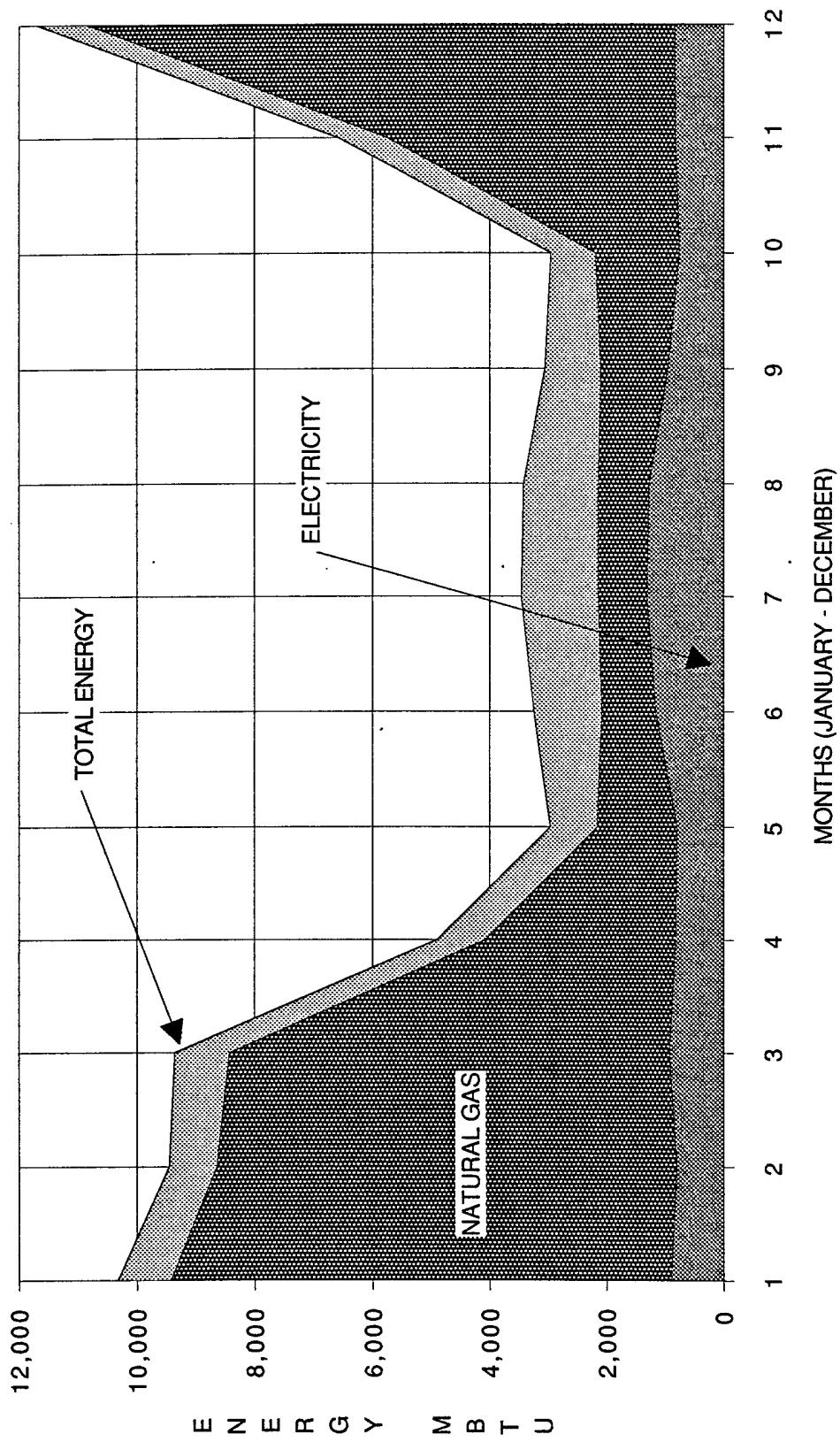
NATURAL GAS COST VS. ELECTRICITY COST



MONTHLY ENERGY COST FOR USDB FACILITY



MONTHLY ENERGY USAGE FOR USDB FACILITY



SUMMARY OF ECO'S

ARCHITECTURAL

ECO A1. Reduce Infiltration

Presently, most of the windows and doors for the buildings located in the USDB have large cracks that allow outside air to infiltrate the buildings. Reduction of the air quantities entering the buildings is not difficult and can be accomplished by weatherstripping and caulking. This work can be performed by the maintenance staff at a low cost.

Because computer modeling of this ECO showed poor economic return, we do not recommend it.

ECO A2. Window Replacement

This ECO studied the installation of double glazed windows anywhere single glazed windows exist. The replacement windows are hermetically sealed with an air gap between the two plates of glass. Infiltration into the building is usually decreased because the new windows seal the opening better.

The double glazed windows have much better insulating quality than single glazed windows. However, they are expensive to install and will not provide an adequate payback unless new windows are already required. Therefore, we are not recommending this ECO.

ECO A3. Attic Insulation

The addition of insulation to the building attics will reduce the overall heat transfer coefficient of their roofs, translating into a decreased amount of heat transferred to or from the interior spaces of the building.

Installation of 10" fiberglass batt insulation in the attics of the existing buildings is not difficult and can be accomplished by the maintenance staff.

This ECO is recommended for buildings 464, 472, and 475.

ECO A4. Dock Door Replacement

This opportunity for heating energy conservation relates to a dock door located in building 470. The existing overhead dock door is in poor condition. The energy savings associated with a new door is derived from a reduction in heat transferred from interior spaces and from

decreased infiltration. The USDB carpentry shop would be required to replace the door to make the project feasible.

ECO A5. Vestibules

Vestibules reduce energy consumption by limiting the amount of outside air infiltration into buildings through frequently used doors. The implementation of this project will change the appearance of the exterior of building #463. At the present time, no vestibules exist at the entrance or exit of this building.

Especially during the heating season, the heating equipment runs non-stop to satisfy the space conditions. Most of the time, however, the temperature conditions are not met. If the heating and cooling equipment were adequately sized, a return on the investment due to energy savings would be more likely. However, we do not recommend this ECO based on existing conditions.

ECO A6. Solar Window Shading

This energy conservation opportunity was studied for all the buildings having cooling. The reduction in solar gain through an unshaded window is beneficial during the cooling season but not during the heating season.

An increase in heating energy may be required to offset the reduced solar heat gain in the winter. Some of the buildings that are entirely air conditioned and that contain large amounts of glass will save energy dollars by the addition of solar film, while other buildings experience increased energy consumption.

The only building showing a payback on this ECO is building 450.

ECO A7. Exterior Wall Insulation

The addition of insulation to exterior building walls was studied and found to be difficult to implement in a facility of this nature. The materials necessary must have reasonable resistance to damage due to the nature of the occupants of the buildings. Because of the expense this type of construction, implementation of this ECO is not feasible.

A9. Architectural Repairs

This section is not an ECO, but a study of architectural repairs recommended for USDB buildings. Many of the items considered do not have a direct relationship to an energy savings but are listed as recommended service items for the USDB. The repairs are small in nature, and some may reduce energy consumption in the buildings, but this is difficult to calculate.

MECHANICAL

ECO M1. Schedule Air Handling Equipment

This ECO studied energy savings associated with scheduling of HVAC equipment for shutoff or setback during periods when heating or cooling are required. This can be accomplished by adding some of the equipment to the existing Energy Management System (EMS) network. This project is recommended for building 465.

ECO M2. Dry-Bulb Economizer Controls

This ECO studies the service or addition of economizer controls and dampers to air handling units utilizing outside air at the present time. The economizer functions by using outside air for cooling when the outdoor temperature is low enough to provide cooling for the building (Approximately 60°F). The air handling units studied now have or had economizer controls and dampers, but do not function properly at this time. This ECO is not recommended at this time.

ECO M3. Service Steam Piping and Traps

This ECO studied the service or replacement of faulty steam traps. Energy savings are shown by a reduction in steam use if the failed traps are repaired so that they do not pass steam into the condensate piping. Steam traps are devices that consistently fail, and are designed to be easily replaceable and repairable. These devices need to be regularly checked and serviced or replaced, if necessary, for maximum system efficiency.

Failure to maintain the steam traps properly results in wasted energy and prevents air from being vented from the piping system, which corrodes the piping, causing premature pipe failure. This ECO is recommended for the USDB.

ECO M5.

This ECO studied the addition of heat recovery systems for the exhausted air from the cell barracks in the Castle Building. The locations of the heat recovery systems are ideal because the exhaust air is directly adjacent to the intake air to be preheated. This ECO is recommended for buildings 475C, 475D, 475G, and 475F.

ECO M6. Insulate Ductwork

This ECO investigates the addition of exterior insulation to supply air ductwork. The heat transferred through the walls of the ductwork is a function of the heat transfer coefficient of the ductwork material. Adding

insulation to the ductwork improves the heat transfer resistance and therefore limits the amount of energy lost.

Uninsulated ductwork routed through unconditioned areas wastes energy. The only ductwork at the USDB facility that is in this category is located in the exterior walls of the Castle building, where installation of insulation is not feasible.

ECO M10. Central Plant Cooling

This ECO studies the replacement of all the packaged air cooling equipment with a central plant chiller producing chilled water for cooling coils located in the air handlers at the individual buildings. In almost all of the cases where a space is being cooled, a packaged direct expansion type of cooling system is utilized.

The cost per BTUH of cooling by a direct expansion type of machine is greater than the cost per BTUH of chilled water system cooling. Replacing the existing direct expansion cooling equipment with a centrifugal chiller plant with cooling towers for heat rejection can conserve energy. However, the cost of removing the existing cooling equipment and installing new chilled water equipment and installing the chilled water distribution piping in the existing tunnels makes this project not feasible.

ECO M11. Castle Air System Repair

This ECO studied the energy savings associated with properly heating and ventilating the cell barracks of the Castle Building. At the present time, the air within the cell barracks is stratified. Air stratification occurs when warm air rises to the upper level of a building and cooler air settles to the lower level. This causes overheating of the upper level in order to provide adequate heating in the lower level.

Repairing the air system in the Castle Building allows the warmer air at the upper level to be recirculated down to the lower level, thereby reducing energy consumption in the building. This ECO is recommended in buildings 475C, 475D, 475F, and 475G.

ECO M12. Reduce Steam Distribution Pressure

This energy conservation opportunity deals with reducing the steam pressure needed for the USDB facility. The laundry requires 120 psi steam, while steam used for space heating can be supplied at 80 psi pressure. Lower pressure steam costs less to generate.

We recommend that the laundry facility be served by a single 120 psi boiler when the existing boilers are replaced (within the next two years).

The space heating requirements of the facility can then be served by two boilers operating at 80 psi.

ECO M14. Service Condensate Return System

This ECO analyzes the energy savings associated with the repair and insulation of the condensate return system serving the Castle Building. The existing piping has holes drilled in the top of the piping in various locations. Repairing these holes will result in less energy loss from the condensate. This repairing and insulating of the condensate piping will result in higher temperature condensate returning to the boiler plant, thus requiring less boiler energy to produce steam. This ECO is recommended.

ECO M15. Boiler Plant Modifications

This ECO studies the boiler plant and any modifications that could save energy. The energy lost during a blowdown of a boiler can be recovered and used to preheat the boiler feedwater. Installing a boiler stack economizer is another possible method of heat recovery off of the boilers. Preheating the combustion air to the boilers will save boiler energy. Oxygen trim control will help improve the operating efficiency of the boilers.

Seven items of energy conservation for the Boiler Plant were investigated and five items were eliminated. The two remaining items, boiler stack economizer and boiler oxygen trim control, offer energy savings.

We recommend that oxygen trim controls be purchased when the existing boilers are replaced within the next two years. Incorporation of any improvements to the existing boilers would be injudicious, because the payback could not be realized before the existing boilers are replaced.

ECO M24. Convert from Steam to Hot Water

This ECO studied the conversion of the existing high pressure steam generation and distribution system to a high temperature hot water type system. The cost per BTUH for using steam is greater than the cost per BTUH for using hot water. The required increase in system efficiency to justify the construction cost is not obtainable, making this ECO not feasible.

ECO M25. Convert from Steam to Cogeneration

Due to the large capital investment and the impact of the operating costs, a very detailed analysis must be performed before funding is considered

for cogeneration. The scope of this ECO is to determine if the investment in a complete cogeneration feasibility study is justified.

Cogeneration is possible when a large heating energy and cooling energy requirement occur simultaneously and for a sufficient time period. The feasibility of cogeneration depends on the facility electrical and thermal loads and how they interrelate. This is especially true when the cost of both electricity and natural gas are moderate, as they are at the USDB.

The most efficient system, offering the best return on investment, would be a cogeneration system tied into a central cooling plant utilizing absorption chillers, which could use the waste heat for cooling purposes.

ECO M26. Reduce Hot Water Temperature

This ECO studied the energy savings associated with a reduction of the domestic hot water temperature used for restrooms and showers. An energy savings can be realized by lower heat losses from the system.

This ECO can be implemented at no cost by directing the maintenance staff to change the setpoint for all water heaters within the USDB from 180°F to 140°F. The reduction in water temperature will reduce the capacity of the domestic hot water system. This ECO is recommended, however, its impact will be reduced by implementation of ECO-M30.

ECO M29. Decentralize Hot Water System

This ECO studied the break-up of the domestic hot water system. At the present time several buildings are served from a hot water tank located in one building. By decentralizing the hot water system, the heat loss from a considerable amount of branch piping can be eliminated. Due to the cost of construction required to implement this ECO, the project is not feasible.

ECO M30. Domestic Water Pipe Insulation

This energy conservation opportunity evaluates the installation of pipe insulation for the domestic hot water piping. Energy is saved by reducing the amount of heat loss from the piping to the surrounding environment. This ECO offers attractive energy savings in the Castle building and in the pipe tunnels and is recommended for the USDB.

ECO M31. Heat Recovery for Laundry

This ECO studied the addition of heat recovery units for the laundry washwater, clothes dryers, and the steam irons to conserve energy usage. The best opportunity for implementation of this ECO would be when the laundry facility reaches a permanent location. By this means,

the heat recovery systems can be incorporated into the design more readily than for installation in an existing facility. Washwater and dryer heat recovery are recommended.

ECO M39. Water Heating Heat Pumps

This ECO studied the replacement of the existing heating and cooling equipment with a heat pump system to condition the interior spaces. In general, heat pumps have a greater efficiency than the existing types of heating and cooling equipment employed in the USDB buildings.

None of the buildings studied for heat pump installations were feasible due to the high construction costs. The heat pump system also has a higher maintenance cost than the existing heating and cooling equipment.

ELECTRICAL

ECO E1. Lighting Levels

This ECO investigates the reduction in lighting levels in areas where the existing lighting was considered to be more than necessary. Installation of motion sensors can provide a good payback in conference rooms and chapels where the lighting loads are high and the space is unoccupied 30% of the time.

ECO E2. Energy Efficient Lighting Systems

This ECO studies the replacement of existing lighting systems with more efficient lighting systems of the same light level. The replacement of lights would reduce the electrical consumption of the lighting system.

We recommend replacing the existing fluorescent lamps and ballasts with high efficiency lamps and ballasts during routine lighting maintenance by the USDB staff.

We also recommend replacement of the existing incandescent light fixtures in building #475A stairwells with high efficiency fluorescent fixtures.

ECO E3. Energy Efficient Motors

This ECO studied the replacement of existing motors that operate fans and pumps with high efficiency motors that have a higher KWh per horsepower rating. The increase in motor efficiency will decrease the amount of electrical energy used by the motors.

We recommend that the motors listed in Volume One of this report with calculated SIR values greater than 1.0 be replaced with high efficiency motors. We also recommend that all new motors installed at the USDB be high efficiency motors.

ENERGY CONSERVATION ANALYSIS

ALL ECO'S INVESTIGATED

ECO	BUILDING NAME	ENERGY SAVINGS MBTU'S/YR	ENERGY SAVINGS (\$)	CONSTRUCTION COST	TOTAL PROJECT COST*	SIMPLE PAYBACK YEARS	SIR
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REDUCE INFILTRATION

A1	BUILDING #463 SOUTH GATE / VISITORS	12	\$49	\$10,617	\$11,254	217.43	0.07
A1	BUILDING #464 OUTSIDE BARBER SHOP	9	\$42	\$5,549	\$5,882	123.73	0.12
A1	BUILDING #465 INSIDE BARBER SHOP	256	\$1,061	\$61,405	\$65,089	58.08	0.28
A1	BUILDING #466 CARPENTRY SHOP	1	\$8	\$18,112	\$19,199	4544.00	0.00
A1	BUILDING #472 PRINT SHOP / COLLEGE	62	\$265	\$25,015	\$26,516	96.18	0.17
A1	BUILDING #473 CLASSIFICATION	12	\$54	\$12,250	\$12,985	215.67	0.07
A1	BUILDING #475 ROTUNDA	15	\$59	\$7,865	\$8,337	129.39	0.12
A1	BUILDING #475A INVESTIGATION	93	\$399	\$9,504	\$10,074	23.61	0.66
A1	BUILDING #475B DINING / LIBRARY	16	\$65	\$9,793	\$10,381	151.20	0.11
A1	BUILDING #475C HSG. UNIT / RECEPTION	42	\$171	\$31,812	\$33,721	186.69	0.09
A1	BUILDING #475D HSG. UNIT / 4-BASE	48	\$195	\$37,748	\$40,013	193.27	0.08
A1	BUILDING #475E DINING / LAUNDRY / GYM	53	\$146	\$42,102	\$44,628	283.56	0.07
A1	BUILDING #475F HSG. UNIT	89	\$365	\$37,990	\$40,269	105.02	0.15
A1	BUILDING #475G HSG. UNIT	41	\$169	\$32,708	\$34,670	196.54	0.08
A1	BUILDING #475H MSA / D&A BOARD / TDS	20	\$85	\$7,563	\$8,017	92.50	0.17

WINDOW REPLACEMENT

A2	BUILDING #450 MENTAL HYGIENE	104	\$455	\$34,048	\$36,091	74.60	0.21
A2	BUILDING #465 INSIDE BARBER SHOP	217	\$892	\$369,241	\$391,395	414.93	0.04
A2	BUILDING #475 ROTUNDA	78	\$317	\$104,902	\$111,196	331.03	0.05
A2	BUILDING #475C HSG. UNIT / RECEPTION	161	\$658	\$208,538	\$221,050	318.52	0.05
A2	BUILDING #475D HSG. UNIT / 4-BASE	237	\$967	\$244,911	\$259,606	254.16	0.06
A2	BUILDING #475F HSG. UNIT	186	\$761	\$244,911	\$259,606	323.81	0.05
A2	BUILDING #475G HSG. UNIT / FEM HSG	164	\$671	\$208,538	\$221,050	312.81	0.05

ATTIC INSULATION

A3	BUILDING #464 OUTSIDE BARBER SHOP	106	\$583	\$3,215	\$3,408	5.54	2.57
A3	BUILDING #472 PRINT SHOP / COLLEGE	34	\$194	\$2,438	\$2,584	11.72	1.19
A3	BUILDING #475 ROTUNDA	142	\$578	\$4,592	\$4,868	7.96	2.03
A3	BUILDING #475E DINING / LAUNDRY / GYM	40	\$169	\$30,487	\$32,316	187.69	0.09

DOCK DOOR REPLACEMENT

A4	BUILDING #470 POPE HALL / VOC SHOP	17	\$69	\$870	\$922	12.65	1.28
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ENERGY CONSERVATION ANALYSIS

ALL ECO'S INVESTIGATED

ECO	BUILDING NAME	ENERGY SAVINGS MBTU'S/YR	ENERGY SAVINGS (\$)	CONSTRUCTION COST	TOTAL PROJECT COST*	SIMPLE PAYBACK YEARS	SIR
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VESTIBULES

A5	BUILDING #463 SOUTH GATE / VISITORS	12	\$49	\$88,238	\$93,532	1807.08	0.01
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SOLAR WINDOW SHADING

A6	BUILDING #450 MENTAL HYGIENE	80	\$498	\$2,001	\$2,121	7.84	1.66
A6	BUILDING #463 SOUTH GATE / VISITORS	-17	(\$53)	\$2,056	\$2,179	-73.68	-0.37
A6	BUILDING #464 OUTSIDE BARBER SHOP	-11	(\$26)	\$1,782	\$1,889	-596.00	-0.20
A6	BUILDING #472 PRINT SHOP / COLLEGE	18	\$74	\$835	\$885	37.41	0.30
A6	BUILDING #473 CLASSIFICATION	-11	\$11	\$2,565	\$2,719	85.80	-0.03
A6	BUILDING #475A INVESTIGATION	32	\$406	\$8,020	\$8,501	20.22	0.55
A6	BUILDING #475B DINING / LIBRARY	6	\$74	\$2,774	\$2,940	37.12	0.30
A6	BUILDING #475H MSA / D&A BOARD / TDS	5	\$60	\$2,610	\$2,767	42.26	0.26

EXTERIOR WALL INSULATION

A7	BUILDING #472 PRINT SHOP / COLLEGE	229	\$1,507	\$57,916	\$61,391	54.83	0.28
A7	BUILDING #475C HSG. UNIT / RECEPTION	154	\$628	\$158,675	\$168,196	253.55	0.06

ARCHITECTURAL REPAIRS

A9	BUILDING #463 SOUTH GATE / VISITORS			\$424	\$449		
A9	BUILDING #465 INSIDE BARBER SHOP			\$1,671	\$1,771		
A9	BUILDING #466 CARPENTRY SHOP			\$582	\$617		
A9	BUILDING #472 PRINT SHOP / COLLEGE			\$1,219	\$1,292		
A9	BUILDING #473 CLASSIFICATION			\$2,132	\$2,260		
A9	BUILDING #475 ROTUNDA			\$13,727	\$14,551		
A9	BUILDING #475A INVESTIGATION			\$1,221	\$1,294		
A9	BUILDING #475E DINING / LAUNDRY / GYM			\$50,302	\$53,320		

SCHEDULE AIR HANDLING EQUIPMENT

M1	BUILDING #463 SOUTH GATE / VISITORS	10	\$51	\$464	\$492	9.32	0.93
M1	BUILDING #464 OUTSIDE BARBER SHOP	45	\$396	\$8,731	\$9,255	21.85	0.42
M1	BUILDING #465 INSIDE BARBER SHOP	280	\$891	\$9,408	\$9,972	10.57	1.03

DRY-BULB ECONOMIZER CONTROLS

M2	BUILDING #463 SOUTH GATE / VISITORS	0	\$3	\$1,459	\$1,547	488.00	0.02
M2	BUILDING #464 OUTSIDE BARBER SHOP	13	\$156	\$1,333	\$1,413	8.85	0.97
M2	BUILDING #473 CLASSIFICATION	1	\$7	\$1,333	\$1,413	191.00	0.05

ENERGY CONSERVATION ANALYSIS

ALL ECO'S INVESTIGATED

ECO	BUILDING NAME	ENERGY SAVINGS MBTU'S/YR	ENERGY SAVINGS (\$)	CONSTRUCTION COST	TOTAL PROJECT COST*	SIMPLE PAYBACK YEARS	SIR
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SERVICE STEAM PIPING AND TRAPS

M3	OWNER TESTING	1,510	\$6,161	\$15,738	\$16,682	2.56	4.55
M3	OUTSIDE TESTING	1,510	\$6,161	\$16,150	\$17,119	2.63	4.44

EXHAUST HEAT RECOVERY

M5	Q-DOT SYSTEM	453	\$2,130	\$12,178	\$12,909	6.66	1.76
M5	Z-DUCT SYSTEM	294	\$1,568	\$12,795	\$13,563	10.81	1.08
M5	COIL LOOP	301	\$953	\$15,352	\$16,273	12.81	0.92

INSULATE DUCTWORK

M6	THIS ECO IS NOT NOT COST EFFECTIVE						
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CENTRAL PLANT COOLING

M10	ALL BUILDINGS IN THE USDB FACILITY	220	\$2,737	\$444,542	\$471,215	162.99	0.05
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CASTLE AIR SYSTEM REPAIR

M11	BUILDING #475C HSG. UNIT / RECEPTION	273	\$1,458	\$1,678	\$1,779	1.51	7.72
M11	BUILDING #475D HSG. UNIT / 4-BASE	277	\$1,474	\$1,678	\$1,779	1.49	7.83
M11	BUILDING #475F HSG. UNIT	307	\$1,641	\$1,678	\$1,779	1.34	8.68
M11	BUILDING #475G HSG. UNIT	247	\$1,323	\$1,678	\$1,779	1.67	6.99

REDUCE STEAM DISTRIBUTION PRESSURE

M12	ALL BUILDINGS IN THE USDB FACILITY	605	\$2,470	\$9,369	\$9,931	3.81	3.06
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CONDENSATE RETURN SYSTEM SERVICE

M14	ALL BUILDINGS IN THE USDB FACILITY	1,687	\$6,883	\$35,958	\$38,115	5.24	2.23
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BOILER PLANT MODIFICATIONS

M15	ECONOMIZER HEAT RECOVERY	280	\$1,142	\$22,852	\$24,223	20.08	0.58
M15	OXYGEN TRIM CONTROLS	3,397	\$13,860	\$36,865	\$39,077	2.67	4.37

CONVERT FROM STEAM TO HOT WATER

M24	ALL BUILDINGS IN THE USDB FACILITY	14,464	\$52,024	\$634,367	\$672,429	12.24	1.00
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CONVERT FROM STEAM TO COGENERATION

M25	ALL BUILDINGS IN THE USDB FACILITY		\$58,138	\$1,200,000	\$1,272,000	21.00	
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ENERGY CONSERVATION ANALYSIS

ALL ECO'S INVESTIGATED

ECO	BUILDING NAME	ENERGY SAVINGS MBTU'S/YR	ENERGY SAVINGS (\$)	CONSTRUCTION COST	TOTAL PROJECT COST*	SIMPLE PAYBACK YEARS	SIR
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REDUCE HOT WATER TEMPERATURE

M26	BUILDING #475 ROTUNDA	23	\$92	\$0	\$0	IMMEDIATELY	
M26	CASTLE BUILDINGS 475C, 475D, 475F, 475G	51	\$210	\$0	\$0	IMMEDIATELY	
M26	BUILDING #475E DINING / LAUNDRY / GYM	33	\$134	\$0	\$0	IMMEDIATELY	
M26	TUNNELS	73	\$299	\$0	\$0	IMMEDIATELY	

DECENTRALIZE HOT WATER SYSTEM

M29	BLDG'S. 450, 463, 464, 466, 467, 468, 472, & 473	243	\$1,296	\$19,599	\$20,775	19.85	0.59
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DOMESTIC WATER PIPE INSULATION

M30	CASTLE BUILDING	147	\$787	\$1,365	\$1,447	2.28	5.11
M30	PIPE TUNNELS	55	\$293	\$454	\$481	2.03	5.75

HEAT RECOVERY FOR LAUNDRY

M31	WASH WATER HEAT RECOVERY	3,871	\$15,742	\$43,829	\$46,459	2.79	4.18
M31	DRYER EXHAUST HEAT RECOVERY	2,748	\$10,597	\$111,688	\$118,389	10.58	1.13

WATER HEATING HEAT PUMPS

M39	BUILDING #450 MENTALHYGIENE	9	\$117	\$73,293	\$77,691	656.70	0.01
M39	BUILDING #463 SOUTH GATE / VISITORS	1	\$106	\$53,565	\$56,779	521.87	0.02
M39	BUILDING #464 OUTSIDE BARBER SHOP	16	\$163	\$59,685	\$63,266	34.46	0.34
M39	BUILDING #465 INSIDE BARBER SHOP	307	\$1,342	\$39,012	\$41,353	29.11	0.39
M39	BUILDING #472 PRINT SHOP / COLLEGE	166	\$851	\$159,692	\$169,274	189.65	0.06
M39	BUILDING #473 CLASSIFICATION	17	\$212	\$86,261	\$91,437	410.25	0.02
M39	BUILDING #475A INVESTIGATION	20	\$249	\$97,188	\$103,019	391.68	0.02
M39	BUILDING #475B DINING / LIBRARY	12	\$154	\$61,228	\$64,902	412.37	0.02
M39	BUILDING #475H MSA / D&A BOARD / TDS	9	\$115	\$46,915	\$49,730	420.35	0.02

LIGHTING LEVELS

E1	BUILDING #450 CONFERENCE ROOM	3	\$34	\$201	\$213	5.90	1.90
E1	BUILDING #475A CONFERENCE ROOM	1	\$17	\$201	\$213	11.80	0.90
E1	BUILDING #475A CHAPEL	3	\$43	\$201	\$213	4.70	2.40
E1	BUILDING #475E CONFERENCE ROOM	1	\$13	\$201	\$213	15.70	0.70
E1	BUILDING #475B CHAPEL	3	\$40	\$201	\$213	5.00	2.20
E1	BUILDING #475H CHAPEL	2	\$21	\$201	\$213	9.50	1.20

ENERGY CONSERVATION ANALYSIS

ALL ECO'S INVESTIGATED

ECO	BUILDING NAME	ENERGY SAVINGS MBTU'S/YR	ENERGY SAVINGS (\$)	CONSTRUCTION COST	TOTAL PROJECT COST*	SIMPLE PAYBACK YEARS	SIR
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ENERGY EFFICIENT LIGHTING SYSTEMS

E2	BUILDING #475A INVESTIGATION	8	\$100	\$124	\$131	1.24	9.00
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ENERGY EFFICIENT MOTORS

E3	ALL BUILDINGS IN THE USDB FACILITY	248	\$3,085	\$20,929	\$22,185	6.80	1.60
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ENERGY CONSERVATION ANALYSIS

ALL ECO'S RECOMMENDED

ECO	BUILDING NAME	ENERGY SAVINGS MBTU'S/YR	ENERGY SAVINGS (\$)	CONSTRUCTION COST	TOTAL PROJECT COST*	SIMPLE PAYBACK YEARS	SIR
ATTIC INSULATION							
A3	BUILDING #464 OUTSIDE BARBER SHOP	106	\$583	\$3,215	\$3,408	5.54	2.57
A3	BUILDING #472 PRINT SHOP / COLLEGE	34	\$194	\$2,438	\$2,584	11.72**	1.19
A3	BUILDING #475 ROTUNDA	142	\$578	\$4,592	\$4,868	7.96	2.03
DOCK DOOR REPLACEMENT							
A4	BUILDING #470 POPE HALL / VOC SHOP	17	\$69	\$870	\$922	12.65**	1.28
SOLAR WINDOW SHADING							
A6	BUILDING #450 MENTAL HYGIENE	80	\$498	\$2,001	\$2,121	5.00	2.96
SCHEDULE AIR HANDLING EQUIPMENT							
M1	BUILDING #465 INSIDE BARBER SHOP	280	\$891	\$9,408	\$9,972	10.57**	1.03
SERVICE STEAM PIPING AND TRAPS							
M3	OWNER TESTING	1,510	\$6,161	\$15,738	\$16,682	2.56	4.55
M3	OUTSIDE TESTING	1,510	\$6,161	\$16,150	\$17,119	2.63	4.44
EXHAUST HEAT RECOVERY							
M5	Q-DOT SYSTEM	453	\$2,130	\$12,178	\$12,909	6.66	1.76
M5	Z-DUCT SYSTEM	294	\$1,568	\$12,795	\$13,563	10.81**	1.08
CASTLE AIR SYSTEM REPAIR							
M11	BUILDING #475C HSG. UNIT / RECEPTION	273	\$1,458	\$1,678	\$1,779	1.51	7.72
M11	BUILDING #475D HSG. UNIT / 4-BASE	277	\$1,474	\$1,678	\$1,779	1.49	7.83
M11	BUILDING #475F HSG. UNIT	307	\$1,641	\$1,678	\$1,779	1.34	8.68
M11	BUILDING #475G HSG. UNIT	247	\$1,323	\$1,678	\$1,779	1.67	6.99
REDUCE STEAM DISTRIBUTION PRESSURE							
M12	ALL BUILDINGS IN THE USDB FACILITY	605	\$2,470	\$9,369	\$9,931	3.81	3.06
CONDENSATE RETURN SYSTEM SERVICE							
M14	ALL BUILDINGS IN THE USDB FACILITY	1,687	\$6,883	\$35,958	\$38,115	5.24	2.23
BOILER PLANT MODIFICATIONS							
M15	OXYGEN TRIM CONTROLS	3,397	\$13,860	\$36,865	\$39,077	2.67	4.37

*TOTAL PROJECT COST IS CONSTRUCTION COST + 6% SIOH

** PB > 10 YEARS; PROJECT NOT AVAILABLE FOR FUNDING.

ENERGY CONSERVATION ANALYSIS

ALL ECO'S RECOMMENDED

ECO	BUILDING NAME	ENERGY SAVINGS MBTU'S/YR	ENERGY SAVINGS (\$)	CONSTRUCTION COST	TOTAL PROJECT COST*	SIMPLE PAYBACK YEARS	SIR
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REDUCE HOT WATER TEMPERATURE

M26	BUILDING #475 ROTUNDA	23	\$92	\$0	\$0	IMMEDIATELY	
M26	CASTLE BUILDINGS 475C, 475D, 475F, 475G	51	\$210	\$0	\$0	IMMEDIATELY	
M26	BUILDING #475E DINING / LAUNDRY / GYM	33	\$134	\$0	\$0	IMMEDIATELY	
M26	TUNNELS	73	\$299	\$0	\$0	IMMEDIATELY	

DOMESTIC WATER PIPE INSULATION

M30	CASTLE BUILDING	147	\$787	\$1,365	\$1,447	2.28	5.11
M30	PIPE TUNNELS	55	\$293	\$454	\$481	2.03	5.75

HEAT RECOVERY FOR LAUNDRY

M31	WASH WATER HEAT RECOVERY	3,871	\$15,742	\$43,829	\$46,459	2.79	4.18
M31	DRYER EXHAUST HEAT RECOVERY	2,748	\$10,597	\$111,688	\$118,389	10.58**	1.13

LIGHTING LEVELS

E1	BUILDING #450 CONFERENCE ROOM	3	\$34	\$201	\$213	5.90	1.90
E1	BUILDING #475A CHAPEL	3	\$43	\$201	\$213	4.70	2.40
E1	BUILDING #475B CHAPEL	3	\$40	\$201	\$213	5.00	2.20
E1	BUILDING #475H CHAPEL	2	\$21	\$201	\$213	9.50	1.20

ENERGY EFFICIENT LIGHTING SYSTEMS

E2	BUILDING #475A INVESTIGATION	8	\$100	\$124	\$131	1.24	9.00
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ENERGY EFFICIENT MOTORS

E3	ALL BUILDINGS IN THE USDB FACILITY	248	\$3,085	\$20,929	\$22,185	6.80	1.60
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*TOTAL PROJECT COST IS CONSTRUCTION COST + 6% SIOH

** PB > 10 YEARS; PROJECT NOT AVAILABLE FOR FUNDING.

ENERGY CONSERVATION ANALYSIS

ALL ECO'S REJECTED

ECO	BUILDING NAME	ENERGY SAVINGS MBTU'S/YR	ENERGY SAVINGS (\$)	CONSTRUCTION COST	TOTAL PROJECT COST*	SIMPLE PAYBACK YEARS	SIR
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REDUCE INFILTRATION

A1	BUILDING #463 SOUTH GATE / VISITORS	12	\$49	\$10,617	\$11,254	217.43	0.07
A1	BUILDING #464 OUTSIDE BARBER SHOP	9	\$42	\$5,549	\$5,882	123.73	0.12
A1	BUILDING #465 INSIDE BARBER SHOP	256	\$1,061	\$61,405	\$65,089	58.08	0.28
A1	BUILDING #466 CARPENTRY SHOP	1	\$8	\$18,112	\$19,199	4544.00	0.00
A1	BUILDING #472 PRINT SHOP / COLLEGE	62	\$265	\$25,015	\$26,516	96.18	0.17
A1	BUILDING #473 CLASSIFICATION	12	\$54	\$12,250	\$12,985	215.67	0.07
A1	BUILDING #475 ROTUNDA	15	\$59	\$7,865	\$8,337	129.39	0.12
A1	BUILDING #475A INVESTIGATION	93	\$399	\$9,504	\$10,074	23.61	0.66
A1	BUILDING #475B DINING / LIBRARY	16	\$65	\$9,793	\$10,381	151.20	0.11
A1	BUILDING #475C HSG. UNIT / RECEPTION	42	\$171	\$31,812	\$33,721	186.69	0.09
A1	BUILDING #475D HSG. UNIT / 4-BASE	48	\$195	\$37,748	\$40,013	193.27	0.08
A1	BUILDING #475E DINING / LAUNDRY / GYM	53	\$146	\$42,102	\$44,628	283.56	0.07
A1	BUILDING #475F HSG. UNIT	89	\$365	\$37,990	\$40,269	105.02	0.15
A1	BUILDING #475G HSG. UNIT	41	\$169	\$32,708	\$34,670	196.54	0.08
A1	BUILDING #475H MSA / D&A BOARD / TDS	20	\$85	\$7,563	\$8,017	92.50	0.17

WINDOW REPLACEMENT

A2	BUILDING #450 MENTAL HYGIENE	104	\$455	\$34,048	\$36,091	74.60	0.21
A2	BUILDING #465 INSIDE BARBER SHOP	217	\$892	\$369,241	\$391,395	414.93	0.04
A2	BUILDING #475 ROTUNDA	78	\$317	\$104,902	\$111,196	331.03	0.05
A2	BUILDING #475C HSG. UNIT / RECEPTION	161	\$658	\$208,538	\$221,050	318.52	0.05
A2	BUILDING #475D HSG. UNIT / 4-BASE	237	\$967	\$244,911	\$259,606	254.16	0.06
A2	BUILDING #475F HSG. UNIT	186	\$761	\$244,911	\$259,606	323.81	0.05
A2	BUILDING #475G HSG. UNIT / FEM HSG	164	\$671	\$208,538	\$221,050	312.81	0.05

ATTIC INSULATION

A3	BUILDING #475E DINING / LAUNDRY / GYM	40	\$169	\$30,487	\$32,316	187.69	0.09
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ENERGY CONSERVATION ANALYSIS

ALL ECO'S REJECTED

ECO	BUILDING NAME	ENERGY SAVINGS MBTU'S/YR	ENERGY SAVINGS (\$)	CONSTRUCTION COST	TOTAL PROJECT COST*	SIMPLE PAYBACK YEARS	SIR
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VESTIBULES

A5	BUILDING #463 SOUTH GATE / VISITORS	12	\$49	\$88,238	\$93,532	1807.08	0.01
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SOLAR WINDOW SHADING

A6	BUILDING #463 SOUTH GATE / VISITORS	-17	(\$53)	\$2,056	\$2,179	-73.68	-0.37
A6	BUILDING #464 OUTSIDE BARBER SHOP	-11	(\$26)	\$1,782	\$1,889	-596.00	-0.20
A6	BUILDING #472 PRINT SHOP / COLLEGE	18	\$74	\$835	\$885	37.41	0.30
A6	BUILDING #473 CLASSIFICATION	-11	\$11	\$2,565	\$2,719	85.80	-0.03
A6	BUILDING #475A INVESTIGATION	32	\$406	\$8,020	\$8,501	20.22	0.55
A6	BUILDING #475B DINING / LIBRARY	6	\$74	\$2,774	\$2,940	37.12	0.30
A6	BUILDING #475H MSA / D&A BOARD / TDS	5	\$60	\$2,610	\$2,767	42.26	0.26

EXTERIOR WALL INSULATION

A7	BUILDING #472 PRINT SHOP / COLLEGE	229	\$1,507	\$57,916	\$61,391	54.83	0.28
A7	BUILDING #475C HSG. UNIT / RECEPTION	154	\$628	\$158,675	\$168,196	253.55	0.06

ARCHITECTURAL REPAIRS

A9	BUILDING #463 SOUTH GATE / VISITORS			\$424	\$449		
A9	BUILDING #465 INSIDE BARBER SHOP			\$1,671	\$1,771		
A9	BUILDING #466 CARPENTRY SHOP			\$582	\$617		
A9	BUILDING #472 PRINT SHOP / COLLEGE			\$1,219	\$1,292		
A9	BUILDING #473 CLASSIFICATION			\$2,132	\$2,260		
A9	BUILDING #475 ROTUNDA			\$13,727	\$14,551		
A9	BUILDING #475A INVESTIGATION			\$1,221	\$1,294		
A9	BUILDING #475E DINING / LAUNDRY / GYM			\$50,302	\$53,320		

SCHEDULE AIR HANDLING EQUIPMENT

M1	BUILDING #463 SOUTH GATE / VISITORS	10	\$51	\$464	\$492	9.32	0.93
M1	BUILDING #464 OUTSIDE BARBER SHOP	45	\$396	\$8,731	\$9,255	21.85	0.42

DRY-BULB ECONOMIZER CONTROLS

M2	BUILDING #463 SOUTH GATE / VISITORS	0	\$3	\$1,459	\$1,547	488.00	0.02
M2	BUILDING #464 OUTSIDE BARBER SHOP	13	\$156	\$1,333	\$1,413	8.85	0.97
M2	BUILDING #473 CLASSIFICATION	1	\$7	\$1,333	\$1,413	191.00	0.05

EXHAUST HEAT RECOVERY

M5	COIL LOOP	301	\$953	\$15,352	\$16,273	12.81	0.92
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ENERGY CONSERVATION ANALYSIS

ALL ECO'S REJECTED

ECO	BUILDING NAME	ENERGY SAVINGS MBTU'S/YR	ENERGY SAVINGS (\$)	CONSTRUCTION COST	TOTAL PROJECT COST*	SIMPLE PAYBACK YEARS	SIR
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INSULATE DUCTWORK

M6	THIS ECO IS NOT NOT COST EFFECTIVE						
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CENTRAL PLANT COOLING

M10	ALL BUILDINGS IN THE USDB FACILITY	220	\$2,737	\$444,542	\$471,215	162.99	0.05
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BOILER PLANT MODIFICATIONS

M15	ECONOMIZER HEAT RECOVERY	280	\$1,142	\$22,852	\$24,223	20.08	0.58
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CONVERT FROM STEAM TO HOT WATER

M24	ALL BUILDINGS IN THE USDB FACILITY	14,464	\$52,024	\$634,367	\$672,429	12.24	1.00
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CONVERT FROM STEAM TO COGENERATION

M25	ALL BUILDINGS IN THE USDB FACILITY		\$58,138	\$1,200,000	\$1,272,000	21.00	
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DECENTRALIZE HOT WATER SYSTEM

M29	BLDG'S. 450, 463, 464, 466, 467, 468, 472, & 473	243	\$1,296	\$19,599	\$20,775	19.85	0.59
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WATER HEATING HEAT PUMPS

M39	BUILDING #450 MENTALHYGIENE	9	\$117	\$73,293	\$77,691	656.70	0.01
M39	BUILDING #463 SOUTH GATE / VISITORS	1	\$106	\$53,565	\$56,779	521.87	0.02
M39	BUILDING #464 OUTSIDE BARBER SHOP	16	\$163	\$59,685	\$63,266	34.46	0.34
M39	BUILDING #465 INSIDE BARBER SHOP	307	\$1,342	\$39,012	\$41,353	29.11	0.39
M39	BUILDING #472 PRINT SHOP / COLLEGE	166	\$851	\$159,692	\$169,274	189.65	0.06
M39	BUILDING #473 CLASSIFICATION	17	\$212	\$86,261	\$91,437	410.25	0.02
M39	BUILDING #475A INVESTIGATION	20	\$249	\$97,188	\$103,019	391.68	0.02
M39	BUILDING #475B DINING / LIBRARY	12	\$154	\$61,228	\$64,902	412.37	0.02
M39	BUILDING #475H MSA / D&A BOARD / TDS	9	\$115	\$46,915	\$49,730	420.35	0.02

LIGHTING LEVELS

E1	BUILDING #475A CONFERENCE ROOM	1	\$17	\$201	\$213	11.80	0.90
E1	BUILDING #475E CONFERENCE ROOM	1	\$13	\$201	\$213	15.70	0.70

**ENERGY CONSERVATION ANALYSIS
ESOS**

PROJECT GROUP	ECO	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS \$	PROJECT COST \$	SIMPLE PAYBACK YRS	SIR
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GROUP 1 In House Low Cost No Cost						
470	Building 470	ECO-A4	17	\$69	\$922	12.65
464	Building 464	ECO-A3	106	\$583	\$3,408	5.54
475	Building 475	ECO-M26	23	\$92	\$0	2.57
	Buildings 475C, 475D, 475F, and 475G	ECO-M26	51	\$210	\$0	
	Tunnels	ECO-M26	73	\$299	\$0	
	GROUP 1 TOTALS		270	\$1,253	\$4,330	6.09
	GROUP 1 FUNDING CATEGORY: LOW COST/NO COST					

GROUP 2 Laundry Heat Recovery						
474	Wash Water Heat Recovery	ECO-M31	3,871	\$15,742	\$46,459	2.79
	GROUP 2 TOTALS		3,871	\$15,742	\$46,459	2.79
	GROUP 2 FUNDING CATEGORY: PECIP					

GROUP 3 Insulate Water Piping						
475	Castle Building	M30	147	787	\$1,447	2.28
	Pipe Tunnels	M30	55	293	\$481	2.03
	GROUP 3 TOTALS		202	\$1,080	\$1,928	2.21
	GROUP 3 FUNDING CATEGORY: LOW COST/NO COST					

GROUP 4 Power Plant						
474	Outside Testing - Steam Traps	M3	1,510	\$6,161	\$17,119	2.63
474	Reduce Steam Pressure	M12	605	\$2,470	\$9,931	3.81
474	Condensate Return System	M14	1,687	\$6,883	\$38,115	5.24
474	Oxygen Trim Controls	M15	3,397	\$13,860	\$39,077	2.67
	GROUP 4 TOTALS		7,199	\$29,374	\$104,242	3.36
	GROUP 4 FUNDING CATEGORY: OSD PIF					

**ENERGY CONSERVATION ANALYSIS
ESOS**

PROJECT GROUP	ECO	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS \$	PROJECT COST \$	SIMPLE PAYBACK YRS	SIR
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GROUP 5 Building 475 Repairs						
475	Attic Insulation - Rotunda	ECO-A3	142	\$578	\$4,868	7.96
475	Exhaust Heat Recovery	ECO-M5	453	\$2,130	\$12,909	6.66
475C	Air System Repair	ECO-M11	273	\$1,458	\$1,779	1.51
475D	Air System Repair	ECO-M11	277	\$1,474	\$1,779	1.49
475F	Air System Repair	ECO-M11	307	\$1,641	\$1,779	1.34
475G	Air System Repair	ECO-M11	247	\$1,323	\$1,779	1.67
475A	Lighting Levels - Chapel	ECO-E1	3	\$43	\$213	4.70
475B	Lighting Levels	ECO-E1	3	\$40	\$213	5.00
475H	Lighting Levels	ECO-E1	2	\$21	\$213	9.50
475A	Energy Efficient Lighting	ECO-E2	8	\$100	\$131	1.24
GROUP 5 TOTALS			1,715	\$8,808	\$25,663	3.40
GROUP 5 FUNDING CATEGORY: PECIP						

GROUP 6 Building 450 Repairs						
450	Solar Window Shading	ECO-A6	36	\$256	\$2,121	7.84
450	Lighting Levels	ECO-E1	3	\$34	\$213	5.90
	GROUP 6 TOTALS		39	\$290	\$2,334	7.58
GROUP 6 FUNDING CATEGORY: LOW COST/NO COST						

GROUP 7 Energy Efficient Motors						
	All Buildings in the USDB	ECO-E3	248	\$3,085	\$22,185	6.81
	GROUP 7 TOTALS		248	\$3,085	\$22,185	6.81
GROUP 7 FUNDING CATEGORY: NONE						

ENERGY AND COST SAVINGS

TOTAL POTENTIAL ENERGY AND COST SAVINGS

		ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS \$/YR
GROUP 1	IN HOUSE LOW COST/NO COST	270	\$1,253
GROUP 2	LAUNDRY HEAT RECOVERY	3,871	\$15,742
GROUP 3	INSULATE DOM. WATER PIPE	202	\$1,080
GROUP 4	POWER PLANT	7,199	\$29,374
GROUP 5	BUILDING 475 REPAIRS	1,715	\$8,808
GROUP 6	BUILDING 450 REPAIRS	39	\$290
GROUP 7	ENERGY EFFICIENT MOTORS	248	\$3,085
TOTAL		13,544	\$59,632

PERCENTAGE OF ENERGY CONSERVED

POTENTIAL ENERGY SAVINGS, MBTU	13,544
EXISTING ENERGY CONSUMPTION, MBTU	55,894
PERCENT ENERGY CONSERVED	24.2%

ENERGY USE AND COST

	ENERGY MBTU/YR	ENERGY \$/YR
BEFORE ECO IMPLEMENTATION	55,894	\$323,459
AFTER ECO IMPLEMENTATION	42,350	\$263,827

GROUP 1

ENERGY CONSERVATION ANALYSIS
ESOS

PROJECT GROUP		ECO	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS \$	PROJECT COST \$	SIMPLE PAYBACK YRS	SIR
	GROUP 1 In House Low Cost No Cost						
470	Building 470	ECO-A4	17	\$69	\$922	12.65	1.28
464	Building 464	ECO-A3	106	\$583	\$3,408	5.54	2.57
475	Building 475	ECO-M26	23	\$92	\$0	\$0	
	Buildings 475C, 475D, 475F, and 475G	ECO-M26	51	\$210	\$0		
	Tunnels	ECO-M26	73	\$299	\$0		
	GROUP 1 TOTALS		270	\$1,253	\$4,330	6.09	1.75
	GROUP 1 FUNDING CATEGORY: LOW COST/NO COST						

ECO-A4

DOCK DOOR REPLACEMENT

**ENERGY ANALYSIS WORKSHEET
USING
ASHRAE MODIFIED BIN METHOD**

BIN TEMP	AVG. DB TEMP	BIN TEMP BELOW 68°F	BIN HOURS PER YEAR	EXIST Q1 U=1.28 A=64	NEW Q2 U=0.17 A=64	EXIST Q3 INFILT. CFM= 52.98	NEW Q4 INFILT. CFM= 4.55	EXIST (Q1+Q3) * (BIN HRS)	NEW Q2+Q4 * (BIN HRS)
100/104	102		3						
95/99	97		41						
90/94	92		197						
85/89	87		436						
80/84	82		638						
75/79	77		788						
70/74	72		710						
65/69	67	1	717	81.92	10.88	57.48	4.94	99952	11341
60/64	62	6	681	491.52	65.28	344.90	29.62	569602	64627
55/59	57	11	587	901.12	119.68	632.32	54.30	900127	102129
50/54	52	16	584	1310.72	174.08	919.73	78.99	1302584	147792
45/49	47	21	539	1720.32	228.48	1207.15	103.67	1577906	179030
40/44	42	26	580	2129.92	282.88	1494.57	128.36	2102202	238517
35/39	37	31	678	2539.52	337.28	1781.98	153.04	2929979	332436
30/34	32	36	589	2949.12	391.68	2069.40	177.72	2955908	335378
25/29	27	41	347	3358.72	446.08	2356.82	202.41	1983291	225025
20/24	22	46	296	3768.32	500.48	2644.23	227.09	1898115	215361
15/19	17	51	153	4177.92	554.88	2931.65	251.77	1087764	123418
10/14	12	56	77	4587.52	609.28	3219.06	276.46	601107	68202
5/9	7	61	67	4997.12	663.68	3506.48	301.14	569741	64643
0/4	2	66	47	5406.72	718.08	3793.90	325.83	432429	49064

**TOTAL EXISTING YEARLY LOAD IN BTU'S 19,010,707
TOTAL NEW YEARLY LOAD IN BTU'S 2,156,962
TOTAL YEARLY LOAD DIFFERENCE IN BTU'S 16,853,745**

Table A4.1

LIFE CYCLE COST ANALYSIS SUMMARY
 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)
 INSTALLATION & LOCATION: FORT LEAVENWORTH - USDB REGION NOS. 7
 PROJECT NO. & TITLE: 1496
 FISCAL YEAR 1990 DISCRETE PORTION NAME: 470A4
 ANALYSIS DATE: 03-30-90 ECONOMIC LIFE 25 YEARS

STUDY: USDBAE
 LCCID 1.035
 CENSUS: 2

PREPARED BY: CRB

1. INVESTMENT						
A. CONSTRUCTION COST					\$	870.
B. SIOH					\$	52.
C. DESIGN COST					\$	48.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9					\$	873.
E. SALVAGE VALUE COST					\$	0.
F. TOTAL INVESTMENT (1D-1E)					\$	873.
2. ENERGY SAVINGS (+) / COST (-)						
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS						
FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)	
A. ELECT	\$ 12.44	0.	\$ 0.	11.16		0.
B. DIST	\$.00	0.	\$ 0.	17.19		0.
C. RESID	\$.00	0.	\$ 0.	17.12		0.
D. NAT G	\$ 4.08	17.	\$ 69.	16.15		1114.
E. COAL	\$.00	0.	\$ 0.	13.92		0.
F. TOTAL		17.	\$ 69.		\$	1114.
3. NON ENERGY SAVINGS(+)/COST(-)						
A. ANNUAL RECURRING (+/-)					\$	0.
(1) DISCOUNT FACTOR (TABLE A)			11.65		\$	0.
(2) DISCOUNTED SAVING/COST (3A X 3A1)					\$	0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4)					\$	0.
D. PROJECT NON ENERGY QUALIFICATION TEST						
(1) 25% MAX NON ENERGY CALC (2F5 X .33)				\$	368.	
A IF 3D1 IS = OR > 3C GO TO ITEM 4						
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=						
C IF 3D1B IS = > 1 GO TO ITEM 4						
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY						
4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE))					\$	69.
5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C)					\$	1114.
6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)=			1.28			
(IF < 1 PROJECT DOES NOT QUALIFY)						
7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4			12.65			

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1AVC-59

ECO-A3

ATTIC INSULATION

ECO-A3 ECONOMIC ANALYSIS

BUILDING NUMBER	STEAM CONSUMPTION			ELECTRIC CONSUMPTION			TOTAL SAVINGS (\$)
	BASE ENERGY (THERMS)	ECO-A3 LOAD (THERMS)	ENERGY SAVINGS (MBTU)	BASE LOAD (KW)	ECO-A3 LOAD (KW)	ENERGY SAVINGS (MBTU)	
463	1,577	1,379	20	83,903	82,814	4	\$127
464	2,195	1,311	88	91,802	86,441	18	\$588
472	15,515	15,241	27	234,490	232,543	7	\$194
475	13,619	12,203	142	58,399	58,386	0	\$578
475E	21,657	21,253	40	611,712	611,617	0	\$169
							\$1,657

LIFE CYCLE COST ANALYSIS SUMMARY
 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)
 INSTALLATION & LOCATION: FORT LEAVENWORTH - USDB REGION NOS. 7
 PROJECT NO. & TITLE: 1496
 FISCAL YEAR 1990 DISCRETE PORTION NAME: 464A3
 ANALYSIS DATE: 03-30-90 ECONOMIC LIFE 25 YEARS

STUDY: USDBAE
 LCCID 1.035
 CENSUS: 2

PREPARED BY: CRB

1. INVESTMENT

A. CONSTRUCTION COST	\$	3215.
B. SIOH	\$	193.
C. DESIGN COST	\$	177.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9	\$	3227.
E. SALVAGE VALUE COST	\$	0.
F. TOTAL INVESTMENT (1D-1E)	\$	3227.

2. ENERGY SAVINGS (+) / COST (-)

ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 12.44	18.	\$ 224.	11.16	2500.
B. DIST	\$.00	0.	\$ 0.	17.19	0.
C. RESID	\$.00	0.	\$ 0.	17.12	0.
D. NAT G.	\$ 4.08	88.	\$ 359.	16.15	5798.
E. COAL	\$.00	0.	\$ 0.	13.92	0.
F. TOTAL		106.	\$ 583.		\$ 8298.

3. NON ENERGY SAVINGS(+)/COST(-)

A. ANNUAL RECURRING (+/-)	\$	0.
(1) DISCOUNT FACTOR (TABLE A)	11.65	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4)	\$	0.
D. PROJECT NON ENERGY QUALIFICATION TEST		

(1) 25% MAX NON ENERGY CALC (2F5 X .33) \$ 2738.
 A IF 3D1 IS = OR > 3C GO TO ITEM 4
 B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=
 C IF 3D1B IS = > 1 GO TO ITEM 4
 D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE))	\$	583.
5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C)	\$	8298.
6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)=	2.57	
(IF < 1 PROJECT DOES NOT QUALIFY)		
7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4		5.54

ENG. FORM 150
1AVC-59

ECO-M26

**REDUCE HOT WATER
TEMPERATURE**

CALCULATION SHEET		DATE Mar-90	SHEET 1	OF 5
PROJECT	USDB ENERGY SAVINGS OPPORTUNITY SURVEY	BASIS FOR CALCULATION		
LOCATION		X	HAND COMPUTER	
ARCHITECT/ENGINEER	CLARK RICHARDSON & BISKUP		CONTRACTOR BID	
ECO MEASURE	ECO-M26		OTHER (SPECIFY)	
		COMPUTED BY RGB	CHECKED BY MAW	

TEST DATA, BTUH LOSS PER LINEAL FOOT

REF: Guidelines for Saving Energy in Existing Buildings
Federal Energy Administration Office of Energy Conservation and Environment

Tables were developed from fig. 44 of the Guidelines for Saving Energy in Existing Buildings

Ambient Temperature 68° F
BTUH Loss per lineal foot of bare pipe

Bare Pipe

Pipe Size	180° Water	160° Water	140° Water	120° Water
3/4"	85	70	55	39
1"	105	85	66	46
1-1/4"	126	104	81	57
1-1/2"	150	121	95	67
2"	171	140	110	80
2-1/2"	205	169	133	94

Table M26-1a

Ambient Temperature 68° F

BTUH Loss per lineal foot of insulated pipe

1/2" Fiberglass Insulation

Pipe Size	180° Water	160° Water	140° Water	120° Water
3/4"	20	15	11	8
1"	21	17	12	9
1-1/4"	26	20	16	11
1-1/2"	30	24	19	13
2"	36	30	23	15
2-1/2"	45	35	27	20

Table M26-1b

CALCULATION SHEET			DATE Mar-90	SHEET 2	OF 5
PROJECT	USDB ENERGY SAVINGS OPPORTUNITY SURVEY		BASIS FOR CALCULATION		
LOCATION			<input checked="" type="checkbox"/> HAND <input type="checkbox"/> COMPUTER <input type="checkbox"/> CONTRACTOR BID <input type="checkbox"/> OTHER (SPECIFY)		
ARCHITECT/ENGINEER	CLARK RICHARDSON & BISKUP				
ECO MEASURE	ECO-M26		COMPUTED BY RGB	CHECKED BY MAW	

TEST DATA, BTUH LOSS PER LINEAL FOOT
 REF: Guidelines for Saving Energy in Existing Buildings
 Federal Energy Administration Office of Energy Conservation and Environment

Tables were developed from fig. 44 of the Guidelines for Saving Energy in Existing Buildings

Ambient Temperature 68° F
 BTUH Loss per lineal foot of bare pipe

Bare Pipe

Pipe Size	Btuh loss @ 180°	Btuh loss @ 140°	Btuh Savings	Hours per Year	\$ Savings per L.F.
3/4"	85	55	30	4380	\$0.70
1"	105	66	39	4380	\$0.91
1-1/4"	126	81	45	4380	\$1.05
1-1/2"	150	95	55	4380	\$1.29
2"	171	110	61	4380	\$1.43
2-1/2"	205	133	72	4380	\$1.68

Table M26-2a

Ambient Temperature 68° F
 BTUH Loss per lineal foot of insulated pipe

1/2" Fiberglass Insulation

Pipe Size	Btuh loss @ 180°	Btuh loss @ 140°	Btuh Savings	Hours per Year	\$ Savings per L.F.
3/4"	20	15	5	4380	\$0.12
1"	22	17	5	4380	\$0.12
1-1/4"	26	20	6	4380	\$0.14
1-1/2"	30	24	6	4380	\$0.14
2"	36	30	6	4380	\$0.14
2-1/2"	45	35	10	4380	\$0.23

Table M26-2b

CALCULATION SHEET		DATE Mar-90	SHEET OF 3 5
PROJECT	USDB ENERGY SAVINGS OPPORTUNITY SURVEY		
LOCATION		X	HAND COMPUTER CONTRACTOR BID OTHER (SPECIFY)
ARCHITECT/ENGINEER	CLARK RICHARDSON & BISKUP		
ECO MEASURE	ECO-M26	COMPUTED BY RGB	CHECKED BY MAW

REDUCED DOMESTIC HOT WATER TEMPERATURE

$$T_m = (Q_1 \cdot T_1) + (Q_2 \cdot T_2) / (Q_1 + Q_2)$$

T_m = mixed water temperature
 T_1 = temperature of fl (Cold Water Temp.)

Assumption:

$T_m = 110$
 $T_1 = 40^\circ$
 $T_2 = X$

Tm (°)	T1 (°)	Q1 (Gal.)	T2 (°)	Q2 (Gal.)
110.00	40.00	68.18	180.00	31.82
110.00	40.00	66.67	170.00	33.33
110.00	40.00	65.00	160.00	35.00
110.00	40.00	63.16	150.00	36.84
110.00	40.00	61.11	140.00	38.89
110.00	40.00	58.82	130.00	41.18
110.00	40.00	56.25	120.00	43.75

Table M26-3

CALCULATION SHEET		DATE Mar-90	SHEET OF 5- 5
PROJECT	USDB ENERGY SAVINGS OPPORTUNITY SURVEY	BASIS FOR CALCULATION	
LOCATION			X HAND
ARCHITECT/ENGINEER			COMPUTER
	CLARK RICHARDSON & BISKUP	CONTRACTOR BID	OTHER (SPECIFY)
ECO MEASURE	ECO-M26	COMPUTED BY RGB	CHECKED BY MAW

TEST DATA, BTUH LOSS PER LINEAL FOOT
 REF: Guidelines for Saving Energy in Existing Buildings
 Federal Energy Administration Office of Energy Conservation and Environment

Tables derived from Tables M26-2a and M26-2b
 Length of pipe estimated from field inspection and plans.

Building 475E

Pipe Size	Feet of Bare Pipe	\$ Savings per Ft.	Feet of Insulated	\$ Savings per FT.		\$ Savings Year
3/4"		\$0.70		\$0.12		\$0
1"		\$0.91		\$0.12		\$0
1-1/4"	100	\$1.05		\$0.14		\$105
1-1/2"	20	\$1.29	20	\$0.14		\$29
2"		\$1.29		\$0.14		\$0

Energy Savings = \$134.00

Tunnels between building 468, 466, 467, 463, 464, 472, 473

Pipe Size	Feet of Bare Pipe	\$ Savings per Ft.	Feet of Insulated	\$ Savings per FT.		\$ Savings Year
3/4"		\$0.70		\$0.23		\$0
1"		\$0.91	180	\$0.23		\$41
1-1/4"	60	\$1.05	90	\$0.28		\$88
1-1/2"	55	\$1.29	355	\$0.28		\$170
2"		\$1.29		\$0.28		\$0

Energy Savings = \$299.00

CALCULATION SHEET			DATE Mar-90	SHEET OF 4 5
PROJECT USDB ENERGY SAVINGS OPPORTUNITY SURVEY			BASIS FOR CALCULATION	
LOCATION			X HAND	
ARCHITECT/ENGINEER CLARK RICHARDSON & BISKUP			COMPUTER	
ECO MEASURE ECO-M26		COMPUTED BY RGB		CHECKED BY MAW

TEST DATA, BTUH LOSS PER LINEAL FOOT

REF: Guidelines for Saving Energy in Existing Buildings
Federal Energy Administration Office of Energy Conservation and Environment

Tables derived from Tables M26-2a and M26-2b
Length of pipe estimated from field inspection and plans.

Building 475

Pipe Size	Feet of Bare Pipe	\$ Savings per Ft.	Feet of Insulated	\$ Savings per FT.		\$ Savings Year
3/4"		\$0.70		\$0.12		\$0
1"		\$0.91		\$0.12		\$0
1-1/4"	60	\$1.05		\$0.14		\$63
1-1/2"	20	\$1.29	20	\$0.14		\$29
2"		\$1.29		\$0.14		\$0

Energy Savings = \$92.00

Buildings 475C, 475D, 475F, 475G

Pipe Size	Feet of Bare Pipe	\$ Savings per Ft.	Feet of Insulated	\$ Savings per FT.		\$ Savings Year
3/4"		\$0.70		\$0.23		\$0
1"		\$0.91		\$0.23		\$0
1-1/4"	200	\$1.05	0	\$0.28		\$210
1-1/2"		\$1.29		\$0.28		\$0
2"		\$1.29		\$0.28		\$0

Energy Savings = \$210.00

LIFE CYCLE COST ANALYSIS SUMMARY
 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)
 INSTALLATION & LOCATION: FORT LEAVENWORTH - USDB REGION NOS. 7
 PROJECT NO. & TITLE: 1496
 FISCAL YEAR 1990 DISCRETE PORTION NAME: GROUP #1
 ANALYSIS DATE: 12-5-90 ECONOMIC LIFE 15 YEARS PREPARED BY: CRB

STUDY: USDBAE
 LCCID 1.035
 CENSUS: 2

1. INVESTMENT						
A. CONSTRUCTION COST				\$	4085.	
B. SIOH				\$	245.	
C. DESIGN COST				\$	225.	
D. ENERGY CREDIT CALC (1A+1B+1C)X.9				\$	4100.	
E. SALVAGE VALUE COST				\$	0.	
F. TOTAL INVESTMENT (1D-1E)				\$	4100.	

2. ENERGY SAVINGS (+) / COST (-)

ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 12.44	18.	\$ 224.	8.69	1947.
B. DIST	\$.00	0.	\$ 0.	12.42	0.
C. RESID	\$.00	0.	\$ 0.	12.21	0.
D. NAT G	\$ 4.08	110.	\$ 449.	11.67	5240.
E. COAL	\$.00	0.	\$ 0.	10.36	0.
F. TOTAL		128.	\$ 673.		\$ 7187.

3. NON ENERGY SAVINGS(+)/COST(-)

A. ANNUAL RECURRING (+/-)				\$	0.
(1) DISCOUNT FACTOR (TABLE A)		9.11			
(2) DISCOUNTED SAVING/COST (3A X 3A1)				\$	0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4)				\$	0.
D. PROJECT NON ENERGY QUALIFICATION TEST					
(1) 25% MAX NON ENERGY CALC (2F5 X .33)			\$	2372.	
A IF 3D1 IS = OR > 3C GO TO ITEM 4					
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F=					
C IF 3D1B IS => 1 GO TO ITEM 4					
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY					
4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE))			\$	673.	
5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C)			\$	7187.	
6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)=		1.75			
(IF < 1 PROJECT DOES NOT QUALIFY)					
7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4		6.09			

GROUP 2

ENERGY CONSERVATION ANALYSIS
ESOS

PROJECT GROUP	EOO	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS \$	PROJECT COST \$	SIMPLE PAYBACK YRS	SIR
	GROUP 2 Laundry Heat Recovery					
474	Wash Water Heat Recovery	ECO-M31	3,871	\$15,742	\$46,459	2.79
	GROUP 2 TOTALS		3,871	\$15,742	\$46,459	2.79
GROUP 2 FUNDING CATEGORY: PECIP						

ECO-M31

**HEAT RECOVERY FOR
LAUNDRY**

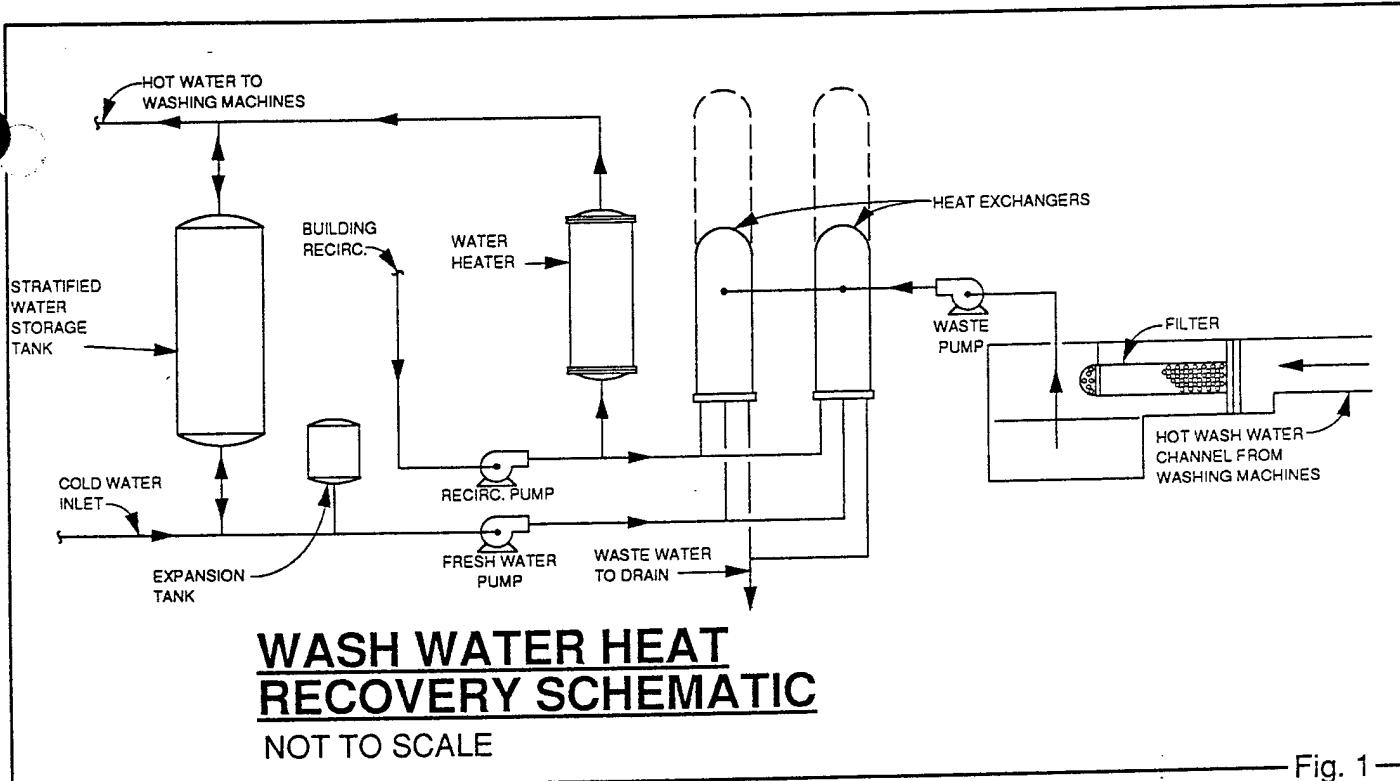


Fig. 1

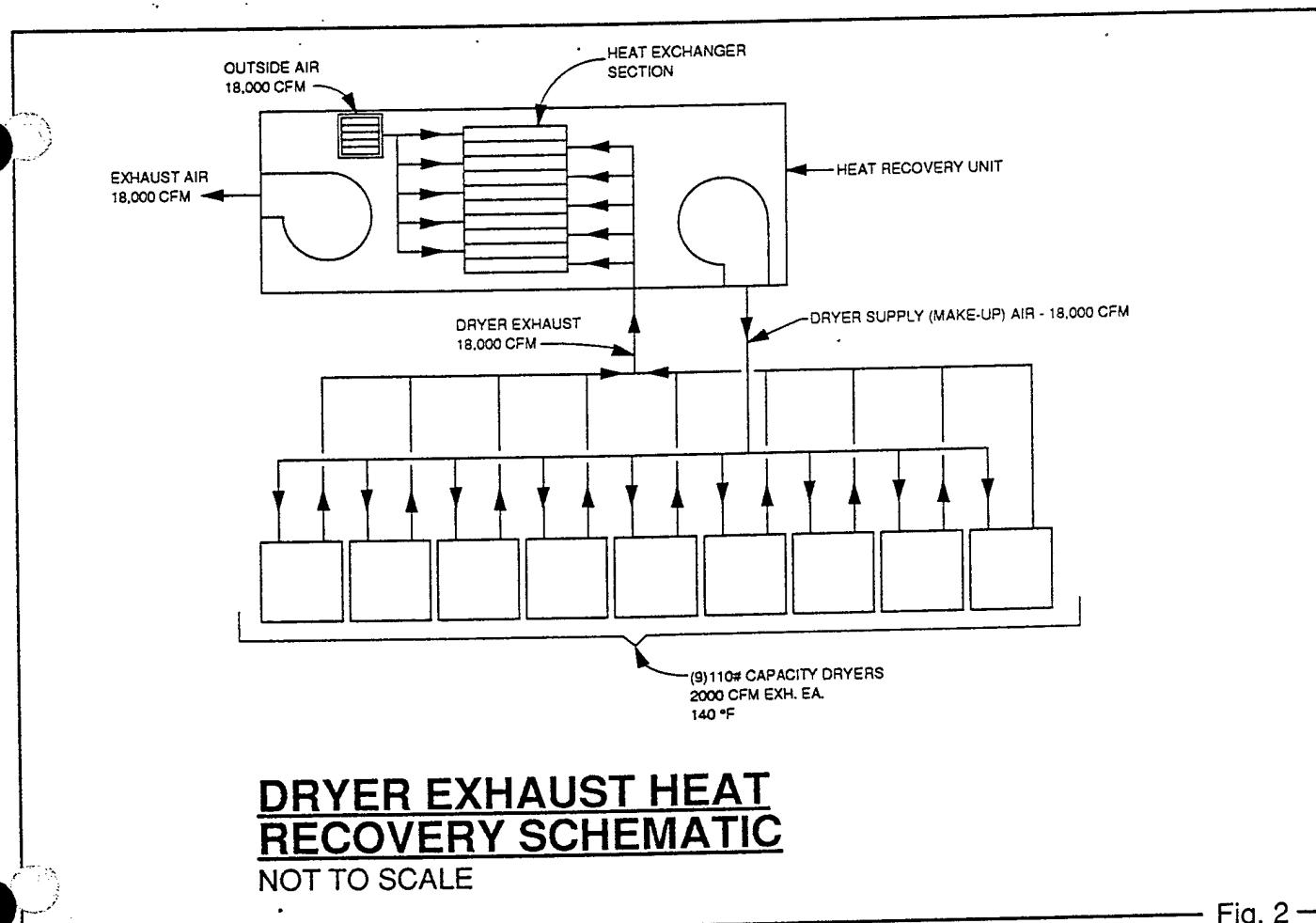


Fig. 2

CALCULATION SHEET		DATE Mar-90	SHEET 1	OF 1
PROJECT	USDB ENERGY SAVINGS OPPORTUNITY SURVEY	BASIS FOR CALCULATION		
LOCATION	FORT LEAVENWORTH, KANSAS	X	HAND COMPUTER CONTRACTOR BID OTHER (SPECIFY)	
ARCHITECT/ENGINEER	CLARK RICHARDSON & BISKUP			
ECO MEASURE	ECO-M31 WASH WATER HEAT RECOVERY	COMPUTED BY BMS	CHECKED BY MAW	

GIVEN:

HOT WATER USE TEMP., °F	160
AVERAGE COLD WATER INLET TEMPERATURE, °F	50
GALLONS WATER/LB. OF LAUNDRY	2.5
PERCENT OF WASTE WATER THAT IS HOT	70
HOURS OF OPERATION PER WEEK	40
ELECTRICITY COST, DOLLARS/MBTU	12.44
GAS COST IN DOLLARS/MBTU	4.08
BOILER SEASONAL EFFICIENCY, %	74

CALCULATED WASTE WATER TEMP., °F	127
WASTE WATER TEMP USED IN ANALYSIS, °F	124

BASED ON HEAT EXCHANGER MANUFACTURER'S
PERFORMANCE DATA FOR 30 GPM UNIT:

SHELL SIDE TEMPERATURE, °F IN/OUT	124 / 91
TUBE SIDE TEMPERATURE, °F IN/OUT	50 / 96

STEAM HEAT RECOVERED, MBTU/YR:	2,870
GAS HEAT RECOVERED, MBTU/YR:	3,878

(2) 30 GPM UNITS ARE REQUIRED.

PUMP ENERGY CALCULATION FOR THIS ECO

FRESH WATER PUMP CAPACITY, GPM:	60
FRESH WATER PUMP HEAD, FT. W:	38
FRESH WATER PUMP EFFICIENCY, %:	65
WASTE WATER PUMP CAPACITY, GPM:	84
WASTE WATER PUMP HEAD, FT. W:	10
WASTE WATER PUMP EFFICIENCY, %:	65
FRESH WATER PUMP POWER CONSUMPTION, WATTS:	662
FRESH WATER PUMP ENERGY USE, MBTU/YEAR:	4.70
WASTE WATER PUMP POWER CONSUMPTION, WATTS:	244
WASTE WATER PUMP ENERGY USE, MBTU/YEAR:	1.73
TOTAL PUMP ENERGY, MBTU/YR.:	6.43

NET ENERGY SAVINGS FOR WASH WATER H.R., MBTU/YR.: 3,872

NET ENERGY SAVINGS, \$/YR: 15,742

LIFE CYCLE COST ANALYSIS SUMMARY
 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)
 INSTALLATION & LOCATION: FORT LEAVENWORTH - USDB REGION NOS. 7
 PROJECT NO. & TITLE: 1496
 FISCAL YEAR 1990 DISCRETE PORTION NAME: ECOM31W
 ANALYSIS DATE: 03-27-90 ECONOMIC LIFE 15 YEARS PREPARED BY: CRB

STUDY: USDBAE
 LCCID 1.035
 CENSUS: 2

1. INVESTMENT						
A. CONSTRUCTION COST					\$	43829.
B. SIOH					\$	2630.
C. DESIGN COST					\$	2411.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9					\$	43983.
E. SALVAGE VALUE COST					-\$	0.
F. TOTAL INVESTMENT (1D-1E)					\$	43983.

2. ENERGY SAVINGS (+) / COST (-)

ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 12.44	-6.	\$ -75.	8.69	-652.
B. DIST	\$.00	0.	\$ 0.	12.42	0.
C. RESID	\$.00	0.	\$ 0.	12.21	0.
D. NAT G	\$ 4.08	3878.	\$ 15822.	11.67	184643.
E. COAL	\$.00	0.	\$ 0.	10.36	0.
F. TOTAL		3872.	\$ 15747.		\$ 183991.

3. NON ENERGY SAVINGS(+)/COST(-)

A. ANNUAL RECURRING (+/-)				\$	0.
(1) DISCOUNT FACTOR (TABLE A)		9.11		\$	0.
(2) DISCOUNTED SAVING/COST (3A X 3A1)				\$	0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4)				\$	0.
D. PROJECT NON ENERGY QUALIFICATION TEST					
(1) 25% MAX NON ENERGY CALC (2F5 X .33)			\$ 60717.		
A IF 3D1 IS = OR > 3C GO TO ITEM 4					
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=					
C IF 3D1B IS = > 1 GO TO ITEM 4					
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY					
4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE))				\$	15747.
5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C)				\$	183991.
6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)=			4.18		
(IF < 1 PROJECT DOES NOT QUALIFY)					
7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4			2.79		

ENG. FORM 150
1AVC-59

LIFE CYCLE COST ANALYSIS SUMMARY
 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)
 INSTALLATION & LOCATION: FORT LEAVENWORTH - USDB REGION NOS. 7
 PROJECT NO. & TITLE: 1496
 FISCAL YEAR 1990 DISCRETE PORTION NAME: GROUP #2
 ANALYSIS DATE: 03-27-90 ECONOMIC LIFE 15 YEARS PREPARED BY: CRB

STUDY: USDBAE
 LCCID 1.035
 CENSUS: 2

1. INVESTMENT						
A. CONSTRUCTION COST					\$ 43829.	
B. SIOH					\$ 2630.	
C. DESIGN COST					\$ 2411.	
D. ENERGY CREDIT CALC (1A+1B+1C)X.9					\$ 43983.	
E. SALVAGE VALUE COST					\$ 0.	
F. TOTAL INVESTMENT (1D-1E)					\$ 43983.	

2. ENERGY SAVINGS (+) / COST (-)
 ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 12.44	-6.	\$ -75.	8.69	-652.
B. DIST	\$.00	0.	\$ 0.	12.42	0.
C. RESID	\$.00	0.	\$ 0.	12.21	0.
D. NAT G	\$ 4.08	3878.	\$ 15822.	11.67	184643.
E. COAL	\$.00	0.	\$ 0.	10.36	0.
F. TOTAL		3872.	\$ 15747.		\$ 183991.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)				\$ 0.
(1) DISCOUNT FACTOR (TABLE A)		9.11		
(2) DISCOUNTED SAVING/COST (3A X 3A1)				\$ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3Bd4) \$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST

(1) 25% MAX NON ENERGY CALC (2F5 X .33) \$ 60717.
 A IF 3D1 IS = OR > 3C GO TO ITEM 4
 B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=
 C IF 3D1B IS = > 1 GO TO ITEM 4
 D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) \$ 15747.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) \$ 183991.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 4.18
 (IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 2.79

GROUP 3

ENERGY CONSERVATION ANALYSIS
ESOS

PROJECT GROUP	ECO	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS \$	PROJECT COST \$	SIMPLE PAYBACK YRS	SIR
	GROUP 3 Insulate Water Piping					
475	Castle Building Pipe Tunnels	M30 M30	147 55	787 293	\$1,447 \$481	2.28 2.03
	GROUP 3 TOTALS		202	\$1,080	\$1,928	2.21
						5.27
	GROUP 3 FUNDING CATEGORY: LOW COST/NO COST					

ECO-M30

**DOMESTIC WATER PIPE
INSULATION**

CALCULATION SHEET		DATE Mar-90	SHEET 1	OF 2
PROJECT	USDB ENERGY SAVINGS OPPORTUNITY SURVEY			
LOCATION				
ARCHITECT/ENGINEER	CLARK RICHARDSON & BISKUP			
ECO MEASURE	ECO-M30	COMPUTED BY RGB	CHECKED BY MAW	

TEST DATA, BTUH LOSS PER LINEAL FOOT

REF: Guidelines for Saving Energy in Existing Buildings
Federal Energy Administration Office of Energy Conservation and Environment

Table was developed from fig. 44 of the Guidelines for Saving Energy in Existing Buildings

Ambient Temperature 68° F

Domestic Hot Water Temperature 180°

Pipe Size	BTUH Loss Bare Pipe	BTUH Loss Insulated	BTUH Savings	Hours per Year	\$ Savings per L.F.
3/4"	85	19	66	4380	\$1.54
1"	105	23	82	4380	\$1.92
1-1/4"	126	26	100	4380	\$2.34
1-1/2"	150	31	119	4380	\$2.78
2"	171	37	134	4380	\$3.13
2-1/2"	250	45	205	4380	\$4.79

CALCULATION SHEET		DATE Mar-90	SHEET 2	OF 2
PROJECT	USDB ENERGY SAVINGS OPPORTUNITY SURVEY			
LOCATION				
ARCHITECT/ENGINEER	CLARK RICHARDSON & BISKUP			
ECO MEASURE	ECO-M30			
			COMPUTED BY RGB	CHECKED BY MAW

TEST DATA, BTUH LOSS PER LINEAL FOOT

REF: Guidelines for Saving Energy in Existing Buildings
Federal Energy Administration Office of Energy Conservation and Environment

Tables derived from Tables M26-2a and M26-2b
Length of pipe estimated from field inspection and plans.

Castle Buildings

Pipe Size	Feet of Bare Pipe	\$ Savings per Ft.	\$ Savings Year
3/4"	80	\$1.54	\$123
1"		\$1.92	\$0
1-1/4"	260	\$2.34	\$608
1-1/2"	20	\$2.78	\$56
2"		\$3.13	\$0

Energy Savings = \$787.00

Pipe Tunnels

Pipe Size	Feet of Bare Pipe	\$ Savings per Ft.	\$ Savings Year
3/4"		\$1.54	\$0
1"		\$1.92	\$0
1-1/4"	60	\$2.34	\$140
1-1/2"	55	\$2.78	\$153
2"		\$3.13	\$0

Energy Savings = \$293.00

LIFE CYCLE COST ANALYSIS SUMMARY
 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)
 INSTALLATION & LOCATION: FORT LEAVENWORTH - USDB REGION NOS. 7
 PROJECT NO. & TITLE: 1496
 FISCAL YEAR 1990
 ANALYSIS DATE: 03-30-90

STUDY: USDBAE
 LCCID 1.035
 CENSUS: 2

DISCRETE PORTION NAME: ECOM30PT
 ECONOMIC LIFE 15 YEARS

PREPARED BY: CRB

1. INVESTMENT						
A. CONSTRUCTION COST					\$	454.
B. SIOH					\$	27.
C. DESIGN COST					\$	25.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9					\$	455.
E. SALVAGE VALUE COST					\$	0.
F. TOTAL INVESTMENT (1D-1E)					\$	455.

2. ENERGY SAVINGS (+) / COST (-)

ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 12.44	0.	\$ 0.	8.69	0.
B. DIST	\$.00	0.	\$ 0.	12.42	0.
C. RESID	\$.00	0.	\$ 0.	12.21	0.
D. NAT G	\$ 4.08	55.	\$ 224.	11.67	2614.
E. COAL	\$.00	0.	\$ 0.	10.36	0.
F. TOTAL		55.	\$ 224.		\$ 2614.

3. NON ENERGY SAVINGS(+)/COST(-)

A. ANNUAL RECURRING (+/-)					
(1) DISCOUNT FACTOR (TABLE A)		9.11			
(2) DISCOUNTED SAVING/COST (3A X 3A1)				\$	0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4)				\$	0.

D. PROJECT NON ENERGY QUALIFICATION TEST

(1) 25% MAX NON ENERGY CALC (2F5 X .33) \$ 863.
 A IF 3D1 IS = OR > 3C GO TO ITEM 4
 B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=
 C IF 3D1B IS = > 1 GO TO ITEM 4
 D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE))					
5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C)					\$ 2614.
6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)=			5.75		
(IF < 1 PROJECT DOES NOT QUALIFY)					
7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4				2.03	

ENG. FORM 150
1AVC-59

ENG. FORM 150
1AVC-59

PREVIOUS EDITION MAY BE USED

GROUP 3 - PAGE 7

LIFE CYCLE COST ANALYSIS SUMMARY
 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)
 INSTALLATION & LOCATION: FORT LEAVENWORTH - USDB REGION NOS. 7
 PROJECT NO. & TITLE: 1496
 FISCAL YEAR 1990
 ANALYSIS DATE: 12-5-90

STUDY: USDBAE
 LCCID 1.035
 CENSUS: 2

DISCRETE PORTION NAME: GROUP #3
 ECONOMIC LIFE 15 YEARS
 PREPARED BY: CRB

1. INVESTMENT						
A. CONSTRUCTION COST					\$	1819.
B. SIOH					\$	109.
C. DESIGN COST					\$	100.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9					\$	1825.
E. SALVAGE VALUE COST					\$	0.
F. TOTAL INVESTMENT (1D-1E)					\$	1825.

2. ENERGY SAVINGS (+) / COST (-)
 ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 12.44	0.	\$ 0.	8.69	0.
B. DIST	\$.00	0.	\$ 0.	12.42	0.
C. RESID	\$.00	0.	\$ 0.	12.21	0.
D. NAT G	\$ 4.08	202.	\$ 824.	11.67	9616.
E. COAL	\$.00	0.	\$ 0.	10.36	0.
F. TOTAL		202.	\$ 824.		\$ 9616.

3. NON ENERGY SAVINGS(+)/COST(-)

A. ANNUAL RECURRING (+/-)		\$	0.
(1) DISCOUNT FACTOR (TABLE A)	9.11	\$	0.
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4)		\$	0.
D. PROJECT NON ENERGY QUALIFICATION TEST			
(1) 25% MAX NON ENERGY CALC (2F5 X .33)		\$	3173.
A IF 3D1 IS = OR > 3C GO TO ITEM 4			
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=			
C IF 3D1B IS = > 1 GO TO ITEM 4			
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY			
4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE))		\$	824.
5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C)		\$	9616.
6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)=	5.27		
(IF < 1 PROJECT DOES NOT QUALIFY)			
7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4			2.21

For use of this form see AR 420-17 and DA Pam 420-6; the Proponent agency is the Office of the Chief of Engineers.

DECODED BY WHAT I WISSENIE WORK IS NOT ACCOMPLISHED

DESCRIPTION AND JUSTIFICATION OF WORK TO BE ACCOMPLISHED

Energy will continue to be wasted from the exposed piping to surrounding spaces. Currently, approximately 147 million BTU's per year is wasted from Castle domestic hot water piping, while approximately 55 million BTU's per year is wasted from pipe tunnel piping. In addition, more water will be consumed due to lower point-of-use temperatures.

REQUESTER INFORMATION		PERSON TO CALL FOR ADDITIONAL INFORMATION																									
NAME	ORGANIZATION	TELEPHONE NO.	SIGNATURE																								
<table border="1"> <thead> <tr> <th colspan="2">FORWARD FOR APPROVAL</th> <th colspan="2">APPROVED FOR DESIGN</th> <th colspan="2">SOURCE OF FUNDS</th> </tr> <tr> <th>RECOMMENDED ACTION</th> <th>ENVIRONMENTAL IMPACT</th> <th>ESTIMATED COST</th> <th>WORK TO BE PERFORMED</th> <th colspan="2"></th> </tr> </thead> <tbody> <tr> <td> <input type="checkbox"/> APPROVAL <input type="checkbox"/> DISAPPROVAL <input type="checkbox"/> PROVING AUTHORITY </td> <td> <input checked="" type="checkbox"/> YES <input type="checkbox"/> ENVIRONMENTAL CONSIDERATIONS <input checked="" type="checkbox"/> ES/EIA INITIATED <input type="checkbox"/> ES/EIA COMPLETED </td> <td> FUNDING WC K WC L UNFUNDED </td> <td> \$ 1,928 \$ ____ \$ ____ \$ 88 TOTAL \$ 2,016 </td> <td> <input type="checkbox"/> IN-HOUSE <input type="checkbox"/> SELF-HELP <input type="checkbox"/> CONTRACT <input type="checkbox"/> TROOP </td> <td> FACILITIES ENGINEER DATE SIGNATURE DATE REMARKS </td> </tr> </tbody> </table>				FORWARD FOR APPROVAL		APPROVED FOR DESIGN		SOURCE OF FUNDS		RECOMMENDED ACTION	ENVIRONMENTAL IMPACT	ESTIMATED COST	WORK TO BE PERFORMED			<input type="checkbox"/> APPROVAL <input type="checkbox"/> DISAPPROVAL <input type="checkbox"/> PROVING AUTHORITY	<input checked="" type="checkbox"/> YES <input type="checkbox"/> ENVIRONMENTAL CONSIDERATIONS <input checked="" type="checkbox"/> ES/EIA INITIATED <input type="checkbox"/> ES/EIA COMPLETED	FUNDING WC K WC L UNFUNDED	\$ 1,928 \$ ____ \$ ____ \$ 88 TOTAL \$ 2,016	<input type="checkbox"/> IN-HOUSE <input type="checkbox"/> SELF-HELP <input type="checkbox"/> CONTRACT <input type="checkbox"/> TROOP	FACILITIES ENGINEER DATE SIGNATURE DATE REMARKS						
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SIGNATURE OF APPROVAL AUTHORITY																											
<p>WHITE (ORIGINAL) - PROJECT FILE COPY GREEN - FORWARD TO KEYPUNCH AFTER COMPLETION PINK - FORWARD FILE COPY OR "APPROVAL ACTION" BLOCK</p> <p>GROUP 3 - PAGE 9</p>																											
<p>FOR 4283 EDITION OF 1 FEB 78 WILL BE USED UNTIL EXHAUSTED.</p>																											

GROUP 4

ENERGY CONSERVATION ANALYSIS
ESOS

PROJECT GROUP	ECO	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS \$	PROJECT COST \$	SIMPLE PAYBACK YRS	SIR
	GROUP 4 Power Plant					
474	Outside Testing - Steam Traps	M3	1,510	\$6,161	\$17,119	2.63
474	Reduce Steam Pressure	M12	605	\$2,470	\$9,931	3.81
474	Condensate Return System	M14	1,687	\$6,883	\$38,115	5.24
474	Oxygen Trim Controls	M15	3,397	\$13,860	\$39,077	2.67
	GROUP 4 TOTALS		7,199	\$29,374	\$104,242	4.37
	GROUP 4 FUNDING CATEGORY: OSD PIF					

ECO-M3

**SERVICE STEAM PIPING
AND TRAPS**

CALCULATION SHEET		DATE March, 1987	SHEET 1	OF 1
PROJECT	USDB ENERGY SAVINGS OPPORTUNITY SURVEY	BASIS FOR CALCULATION		
LOCATION				
ARCHITECT/ENGINEER	CLARK RICHARDSON & BISKUP	X	HAND COMPUTER CONTRACTOR BID OTHER (SPECIFY)	
ECO MEASURE	STEAM TRAP PROGRAM - OWNER TESTING	COMPUTED BY TGD	CHECKED BY MAW	
<u>COST OF STEAM AT FORT LEAVENWORTH - USDB</u>				
ENTHALPY OF WATER AT 160° F. =	128 BTU/LBM			
ENTHALPY OF STEAM AT 120 PSIG =	1,192 BTU/LBM			
SYSTEM EFFICIENCY =	74%			
NATURAL GAS COST =	\$4.08 MCF			
HEAT CONTENT OF NAT. GAS =	1,000,000 BTU/MCF			
$[(1192-128) \times \$4.08] / (0.74 \times 1,000,000)$	\$5.87 PER THOUSAND LBS. OF STEAM			
<u>COST OF INSPECTING TRAPS AFTER TEST VALVES ARE INSTALLED.</u>				
ASSUMING AN AVERAGE OF 50 TRAPS PER DAY 8 HOURS PER DAY.				
8 MH	x	\$36.75 PER HOUR =	\$294 PER DAY	
\$294	/	50 TRAPS PER DAY =	\$5.88 PER TRAP	
COST OF INSTALLING TEST VALVES ON EACH TRAP =			\$137	
<u>SAVINGS FROM TRAP INSPECTION</u>				
USING 100 TRAPS AS A BASE WITH A 10% FAILURE RATE; 350 LB/HR F&T TRAP				
COST OF INSPECTING TRAPS ONCE DURING THE HEATING SEASON		100 X \$5.88 =	\$588	PER YEAR
NUMBER OF TRAPS FAILED		100 X 10% =	10 TRAPS	
COST OF REPAIRING TRAPS		10 X \$145 =	\$1,450 PER YEAR	
TOTAL COST OF INSPECTING AND REPAIRING TRAPS			\$2,038 PER YEAR	
65 lbs/hr x 4380 hrs/yr x 0.5 (sys. modulation factor) =		142,350 LBS. OF STEAM PER YEAR		
142,350 x (1192-128) / 1,000,000 =		151 MBTU / YEAR / TRAP		
151 x \$5.87 =		\$886 PER TRAP / YEAR		
ENERGY LOST DUE TO FAILED TRAPS		10 X 151 =	1510 MBTU'S PER YEAR	
COST OF STEAM LOST DUE TO FAILED TRAPS		10 X \$886 =	\$8,860 PER YEAR	
INITIAL INVESTMENT FOR TEST VALVES		100 X \$137 =	\$13,700	
CONSTRUCTION COST		\$2,038 + \$13,700 =	\$15,738	

CALCULATION SHEET		DATE March, 1987	SHEET OF 1 1					
PROJECT ATION	USDB ENERGY SAVINGS OPPORTUNITY SURVEY	BASIS FOR CALCULATION						
ARCHITECT/ENGINEER	CLARK RICHARDSON & BISKUP							
ECO MEASURE	STEAM TRAP PROGRAM - OUTSIDE TESTING							
COMPUTED BY TGD		CHECKED BY MAW						
<u>COST OF STEAM AT FORT LEAVENWORTH - USDB</u>								
ENTHALPY OF WATER AT 160° F. =	128 BTU/LBM							
ENTHALPY OF STEAM AT 120 PSIG =	1,192 BTU/LBM							
SYSTEM EFFICIENCY =	74%							
NATURAL GAS COST =	\$4.08 MCF							
HEAT CONTENT OF NAT. GAS =	<u>1,000.000</u> BTU/MCF							
$[(1192-128) \times \$4.08] / (0.74 \times 1,000)$	\$5.87 PER THOUSAND LBS. OF STEAM							
<u>COST OF INSPECTING TRAPS USING AN OUTSIDE TESTING SERVICE.</u>								
ASSUMING AN AVERAGE OF 50 TRAPS PER DAY, 8 HOURS PER DAY. THE COST IS A FLAT FEE OF \$500 PER DAY.								
\$500/50 TRAPS = \$10 PER TRAP								
COST OF INSTALLING TEST VALVES ON EACH TRAP = \$137								
<u>SAVINGS FROM TRAP INSPECTION</u>								
USING 100 TRAPS AS A BASE WITH A 10% FAILURE RATE; 350 LB/HR F&T TRAP								
COST OF INSPECTING TRAPS ONCE DURING THE HEATING SEASON	100 X \$10 =	\$1,000 PER YEAR						
NUMBER OF TRAPS FAILED	100 X 10% =	10 TRAPS						
COST OF REPAIRING TRAPS	10 X \$145 =	\$1,450 PER YEAR						
TOTAL COST OF INSPECTING AND REPAIRING TRAPS		<u>\$2,450</u> PER YEAR						
65 lbs/hr x 4380 hrs/yr x 0.5 (sys. modulation factor) =	142,350 LBS. OF STEAM PER YEAR							
$142,350 \times (1192-128) / 1,000,000 =$	151 MBTU / YEAR / TRAP							
$151 \times \$5.87 =$	\$886 PER TRAP / YEAR							
ENERGY LOST DUE TO FAILED TRAPS	10 X 151 =	1510 MBTU'S PER YEAR						
COST OF STEAM LOST DUE TO FAILED TRAPS	10 X \$886 =	\$8,860 PER YEAR						
INITIAL INVESTMENT FOR TEST VALVES	100 X \$137 =	\$13,700						
CONSTRUCTION COST	$\$2,450 + \$13,700 =$	\$16,150						

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

STUDY: USDBAE
LCCID 1.035
CENSUS: 2

INSTALLATION & LOCATION: FORT LEAVENWORTH - USDB REGION NOS. 7

PROJECT NO. & TITLE: 1496

FISCAL YEAR 1990 DISCRETE PORTION NAME: ECOM3 - OWNER TESTING

ANALYSIS DATE: 03-23-90

ECONOMIC LIFE 15 YEARS

PREPARED BY: CRB

1. INVESTMENT

A. CONSTRUCTION COST	\$	15738.
B. SIOH	\$	944.
C. DESIGN COST	\$	866.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9	\$	15793.
E. SALVAGE VALUE COST	\$	0.
F. TOTAL INVESTMENT (1D-1E)	\$	15793.

2. ENERGY SAVINGS (+) / COST (-)

ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 12.44	0.	\$ 0.	8.69	0.
B. DIST	\$.00	0.	\$ 0.	12.42	0.
C. RESID	\$.00	0.	\$ 0.	12.21	0.
D. NAT G	\$ 4.08	1510.	\$ 6161.	11.67	71899.
E. COAL	\$.00	0.	\$ 0.	10.36	0.
F. TOTAL		1510.	\$ 6161.		\$ 71899.

3. NON ENERGY SAVINGS(+)/COST(-)

A. ANNUAL RECURRING (+/-)	\$	0.
(1) DISCOUNT FACTOR (TABLE A)	9.11	
(2) DISCOUNTED SAVING/COST (3A X 3A1)	\$	0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4)	\$	0.
D. PROJECT NON ENERGY QUALIFICATION TEST		

(1) 25% MAX NON ENERGY CALC (2F5 X .33) \$ 23727.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F= _____
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE))	\$	6161.
5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C)	\$	71899.
6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)=	4.55	
(IF < 1 PROJECT DOES NOT QUALIFY)		
7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4		2.56

LIFE CYCLE COST ANALYSIS SUMMARY
 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)
 INSTALLATION & LOCATION: FORT LEAVENWORTH - USDB REGION NOS. 7
 PROJECT NO. & TITLE: 1496
 FISCAL YEAR 1990
 ANALYSIS DATE: 03-23-90

STUDY: USDBAE
 LCCID 1.035
 CENSUS: 2

DISCRETE PORTION NAME: ECOM3 - OUTSIDE TESTING
 ECONOMIC LIFE 15 YEARS
 PREPARED BY: CRB

1. INVESTMENT

A. CONSTRUCTION COST	\$ 16150.
B. SIOH	\$ 969.
C. DESIGN COST	\$ 888.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9	\$ 16206.
E. SALVAGE VALUE COST	-\$ 0.
F. TOTAL INVESTMENT (1D-1E)	\$ 16206.

2. ENERGY SAVINGS (+) / COST (-)
 ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 12.44	0.	\$ 0.	8.69	0.
B. DIST	\$.00	0.	\$ 0.	12.42	0.
C. RESID	\$.00	0.	\$ 0.	12.21	0.
D. NAT G	\$ 4.08	1510.	\$ 6161.	11.67	71899.
E. COAL	\$.00	0.	\$ 0.	10.36	0.
F. TOTAL		1510.	\$ 6161.		\$ 71899.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)	\$ 0.
(1) DISCOUNT FACTOR (TABLE A)	9.11
(2) DISCOUNTED SAVING/COST (3A X 3A1)	\$ 0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3Bd4)	\$ 0.
D. PROJECT NON ENERGY QUALIFICATION TEST	
(1) 25% MAX NON ENERGY CALC (2F5 X .33)	\$ 23727.
A IF 3D1 IS = OR > 3C GO TO ITEM 4	
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=	_____
C IF 3D1B IS = > 1 GO TO ITEM 4	
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY	
4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE))	\$ 6161.
5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C)	\$ 71899.
6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)=	4.44
(IF < 1 PROJECT DOES NOT QUALIFY)	
7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4	2.63

CONSTRUCTION COST ESTIMATE			DATE PREPARED			SHEET OF 1	
PROJECT USDB ENERGY STUDY			BASIS FOR ESTIMATE <input checked="" type="checkbox"/> CODE A (NO DESIGN COMPLETED) <input type="checkbox"/> CODE B (PRELIMINARY DESIGN) <input type="checkbox"/> CODE C (FINAL DESIGN) <input type="checkbox"/> OTHER (SPECIFY)				
LOCATION FORT LEAVENWORTH, KS							
ARCHITECT/ENGINEER CLARK RICHARDSON & BISKUP			ESTIMATOR TGD		CHECKED BY		
DRAWING NO.		QUANTITY	MATERIAL		LABOR	TOTAL COST	
		NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL		PER UNIT
INSTALL TEST VALVE (PER TRAP)							
CREW 1 STEAM FITTER, 1 APPRENTICE							
DISCONNECT EXISTING PIPE		1.00 MH	\$22.27	\$22	\$20.00	\$20	\$42
INSTALL TEE AND TEST LINE		0.75 MH	\$22.27	\$17	\$5.40	\$4	\$21
INSTALL GLOBE VALVE		0.75 MH	\$22.27	\$17	\$17.10	\$13	\$30
SUBTOTAL				\$56		\$37	\$93
CONTINGENCY 10%			10%	\$6	10%	\$4	\$10
SUBTOTAL				\$62		\$41	\$103
WORK COMP,TAX,SOC.SEC.,INS			3.50%	\$2	13.0%	\$5	\$7
DIRECT COST				\$64		\$46	\$110
OVERHEAD AND PROFIT			25%	\$16	25%	\$11	\$27
SUBTOTAL				\$80		\$57	\$137
CONSTRUCTION COST PER TRAP							\$137

ENG. FORM 150
1AVC-59

ECO-M12

**REDUCE STEAM
DISTRIBUTION PRESSURE**

CALCULATION SHEET		DATE Mar-90	SHEET 1	OF 1			
PROJECT	USDB ENERGY SAVINGS OPPORTUNITY SURVEY	BASIS FOR CALCULATION					
LOCATION	STEAM PLANT	X	HAND COMPUTER	CONTRACTOR BID OTHER (SPECIFY)			
ARCHITECT/ENGINEER	CLARK RICHARDSON & BISKUP						
ECO MEASURE	ECO M12	COMPUTED BY TGD	CHECKED BY MAW				
STEAM PRESSURE	ENTHALPY BTU/LB. OF STEAM	SYSTEM EFFICIENCY	STEAM COST PER 1000 LBS.	ESTIMATED ANNUAL SAVINGS			
120 PSIG	1,192.4	74.000%	\$5.754	NONE			
115 PSIG	1,191.7	74.094%	\$5.742	\$326			
110 PSIG	1,191.0	74.188%	\$5.731	\$624			
105 PSIG	1,190.4	74.282%	\$5.721	\$896			
100 PSIG	1,189.6	74.376%	\$5.709	\$1,222			
95 PSIG	1,188.8	74.470%	\$5.698	\$1,520			
90 PSIG	1,188.0	74.564%	\$5.686	\$1,846			
85 PSIG	1,187.2	74.658%	\$5.675	\$2,145			
80 PSIG	1,186.3	74.752%	\$5.663	\$2,470			
AVERAGE STEAM USE FOR SPACE HEATING:		74,375 LBS PER DAY					
ANNUAL ENERGY SAVINGS (AT 80 PSIG):		605 MBTU'S PER YEAR					
SYSTEM EFFICIENCY CALCULATED FROM:							
IMPROVING BOILER EFFICIENCY BY S.G. DUKELOW							
SPONSORED BY KANSAS STATE UNIVERSITY AND KANSAS ENERGY OFFICE							
CHAPTER 6: EFFECT OF BOILER STEAM PRESSURE ON FLUE GAS TEMPERATURE AND BOILER EFFICIENCY							

ENG. FORM 150
1AVC-59

LIFE CYCLE COST ANALYSIS SUMMARY
 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)
 INSTALLATION & LOCATION: FORT LEAVENWORTH - USDB REGION NOS. 7
 PROJECT NO. & TITLE: 1496
 FISCAL YEAR 1990 DISCRETE PORTION NAME: ECOM12
 ANALYSIS DATE: 03-19-90 ECONOMIC LIFE 15 YEARS PREPARED BY: CRB

STUDY: USDBAE
 LCCID 1.035
 CENSUS: 2

1. INVESTMENT					
A. CONSTRUCTION COST				\$	9369.
B. SIOH				\$	562.
C. DESIGN COST				\$	515.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9				\$	9401.
E. SALVAGE VALUE COST				\$	0.
F. TOTAL INVESTMENT (1D-1E)				\$	9401.

2. ENERGY SAVINGS (+) / COST (-)

ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 12.44	0.	\$ 0.	8.69	0.
B. DIST	\$.00	0.	\$ 0.	12.42	0.
C. RESID	\$.00	0.	\$ 0.	12.21	0.
D. NAT G	\$ 4.08	605.	\$ 2468.	11.67	28802.
E. COAL	\$.00	0.	\$ 0.	10.36	0.
F. TOTAL		605.	\$ 2468.		\$ 28802.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)				\$	0.
(1) DISCOUNT FACTOR (TABLE A)		9.11		\$	0.
(2) DISCOUNTED SAVING/COST (3A X 3A1)				\$	0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3Bd4)				\$	0.
D. PROJECT NON ENERGY QUALIFICATION TEST					
(1) 25% MAX NON ENERGY CALC (2F5 X .33)			\$	9505.	
A IF 3D1 IS = OR > 3C GO TO ITEM 4					
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=					
C IF 3D1B IS = > 1 GO TO ITEM 4					
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY					
4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE))			\$	2468.	
5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C)			\$	28802.	
6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)=		3.06			
(IF < 1 PROJECT DOES NOT QUALIFY)					
7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4		3.81			

ECO-M14

**SERVICE CONDENSATE
RETURN SYSTEM**

CALCULATION SHEET				DATE		SHEET OF	
PROJECT	USDB ENERGY SAVINGS OPPORTUNITY SURVEY			Mar-90		1 1	
LOCATION				X	HAND		
ARCHITECT/ENGINEER					COMPUTER		
ECO MEASURE	CLARK RICHARDSON & BISKUP SERVICE CONDENSATE RETURN SYSTEM ECO-M14				CONTRACTOR BID OTHER (SPECIFY)		
				COMPUTED BY	TGD	CHECKED BY	MAW

INIT TEMP	AMB TEMP	INSUL THICK	WIND VEL	PIPE DIA	INSULATION CHARACTERISTIC			PIPE LEN	FLOW #/HR	SPEC HEAT	EMISS	FINAL TEMP	TOTAL HL
					T 1	CON1	T 2						
212	75	2	1	8.625	460	0.5	100	0.25	700	6200	1.05	0.9	201.1
212	75	0.001	1	8.625	460	0.5	100	0.25	700	6200	1.05	0.9	154.9

CALCULATION SHEET		DATE Mar-90	SHEET 1	OF 1
PROJECT	USDB ENERGY SAVINGS OPPORTUNITY SURVEY	BASIS FOR CALCULATION		
LOCATION		<input checked="" type="checkbox"/> HAND COMPUTER CONTRACTOR BID OTHER (SPECIFY)		
ARCHITECT/ENGINEER	CLARK RICHARDSON & BISKUP			
ECO MEASURE	SERVICE CONDENSATE RETURN SYSTEM ECO-M14	COMPUTED BY TGD	CHECKED BY	

120 PSIG STEAM PRESSURE: 1192.4 BTU/LB. ENTHALPY
 155°F CONDENSATE RETURN TEMPERATURE: 123 BTU/LB. ENTHALPY
 201°F CONDENSATE RETURN TEMPERATURE: 169 BTU/LB. ENTHALPY
 SYSTEM EFFCIENCY: 74%
 AVERAGE DAILY STEAM CONSUMPTION: 148,750 LBS.
 STEAM LOAD SERVED BY WEST TUNNEL: 50%
 DAYS PER YEAR: 365

 (1192.4 - 123) - (1192.4 - 169) / 0.74 = 62.16 BTU/LB.
 (62.16 X 148,750 X .5 X 365)/1,000,000 = 1,687 MBTU/YEAR

LIFE CYCLE COST ANALYSIS SUMMARY
 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)
 INSTALLATION & LOCATION: FORT LEAVENWORTH - USDB REGION NOS. 7
 PROJECT NO. & TITLE: 1496

FISCAL YEAR 1990 DISCRETE PORTION NAME: ECOM14
 ANALYSIS DATE: 03-30-90 ECONOMIC LIFE 15 YEARS

STUDY: USDBAE
 LCCID 1.035
 CENSUS: 2

PREPARED BY: CRB

1. INVESTMENT

A. CONSTRUCTION COST	\$	35958.
B. SIOH	\$	2157.
C. DESIGN COST	\$	1978.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9	\$	36084.
E. SALVAGE VALUE COST	\$	0.
F. TOTAL INVESTMENT (1D-1E)	\$	36084.

2. ENERGY SAVINGS (+) / COST (-)

ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 12.44		\$ 0.	8.69	\$ 0.
B. DIST	\$.00	0.	\$ 0.	12.42	\$ 0.
C. RESID	\$.00	0.	\$ 0.	12.21	\$ 0.
D. NAT G	\$ 4.08	1687.	\$ 6883.	11.67	\$ 80325.
E. COAL	\$.00	0.	\$ 0.	10.36	\$ 0.
F. TOTAL		1687.	\$ 6883.		\$ 80325.

3. NON ENERGY SAVINGS(+)/COST(-)

A. ANNUAL RECURRING (+/-)	\$	0.
(1) DISCOUNT FACTOR (TABLE A)	9.11	
(2) DISCOUNTED SAVING/COST (3A X 3A1)	\$	0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4)	\$	0.
D. PROJECT NON ENERGY QUALIFICATION TEST		
(1) 25% MAX NON ENERGY CALC (2F5 X .33)	\$	26507.
A IF 3D1 IS = OR > 3C GO TO ITEM 4		
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=		
C IF 3D1B IS => 1 GO TO ITEM 4		
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY		

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE))	\$	6883.
5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C)	\$	80325.
6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)=		2.23
(IF < 1 PROJECT DOES NOT QUALIFY)		
7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4		5.24

CONSTRUCTION COST ESTIMATE			DATE PREPARED			SHEET 1	OF 1
			Mar-90				
PROJECT USDB ENERGY STUDY			BASIS FOR ESTIMATE				
LOCATION FORT LEAVENWORTH, KS			<input checked="" type="checkbox"/> X			CODE A (NO DESIGN COMPLETED) CODE B (PRELIMINARY DESIGN) CODE C (FINAL DESIGN) OTHER (SPECIFY)	
ARCHITECT/ENGINEER CLARK RICHARDSON & BISKUP							
DRAWING NO.		ESTIMATOR TGD			CHECKED BY MAW		
	QUANTITY		MATERIAL		LABOR		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
6" DIA. - 2" THICK FIBERGLASS INSULATION	400	LF	\$5.87	\$2,348	\$3.45	\$1,380	\$3,728
ALUMINUM JACKET	400	LF	\$0.54	\$216	\$2.87	\$1,148	\$1,364
8" DIA. SCH. 80 STEEL PIPE	100	LF	\$37.66	\$3,766	\$22.00	\$2,200	\$5,966
8" DIA. - 2" THICK FIBERGLASS INSULATION	200	LF	\$7.25	\$1,450	\$4.31	\$862	\$2,312
ALUMINUM JACKET	200	LF	\$0.54	\$108	\$2.87	\$574	\$682
PIPE RACKS	6	EA	\$400	\$2,400	\$200	\$1,200	\$3,600
REPAIR HOLES IN PIPING	3	DAYS			\$252	\$756	\$756
8" DIA. TEE	2	EA	\$71	\$142	\$71	\$142	\$284
8" DIA. 90° ELBOW	2	EA	\$100	\$200	\$140	\$280	\$480
DEMOLITION	100	LF			\$3.95	\$395	\$395
SUBTOTAL				\$10,630		\$8,937	\$19,567
DIFFICULTY FACTOR 50%					50%	\$4,469	\$4,469
SUBTOTAL						\$13,406	\$24,036
CONTINGENCY 10%			10%	\$1,063	10%	\$1,341	\$2,404
SUBTOTAL				\$11,693		\$14,747	\$26,440
WORK COMP,TAX,SOC.SEC.,INS			3.50%	\$409	13.0%	\$1,917	\$2,326
DIRECT COST				\$12,102		\$16,664	\$28,766
OVERHEAD AND PROFIT			25%	\$3,026	25%	\$4,166	\$7,192
SUBTOTAL				\$15,128		\$20,830	\$35,958
CONSTRUCTION COST							\$35,958

ENG. FORM 150
1AVC-59

ECO-M15

**BOILER PLANT
MODIFICATIONS**

CALCULATION SHEET		DATE Mar-90	SHEET 1	OF 1
PROJECT	USDB ENERGY SAVINGS OPPORTUNITY SURVEY	BASIS FOR CALCULATION		
LOCATION	FORT LEAVENWORTH, KANSAS	<input checked="" type="checkbox"/> HAND		
ARCHITECT/ENGINEER	CLARK RICHARDSON & BISKUP	<input type="checkbox"/> COMPUTER		
ECO MEASURE	ECO-M15 O2 TRIM CONTROLS	<input type="checkbox"/> CONTRACTOR BID		
		<input type="checkbox"/> OTHER (SPECIFY)		
		COMPUTED BY BMS	CHECKED BY MAW	

BUILDING 474 - CENTRAL HEATING PLANT

TEST DATA, BOILER #2

% OXYGEN	6.3 %
STACK TEMPERATURE	450 ° F
% EXCESS AIR	37. %
COMBUSTION EFFICIENCY	80.50%
%CO 2	8.3 %

STEAM PRODUCTION, ACCORDING TO BOILER PLANT OPERATORS:

SUMMER	75,000 LBS/DAY
WINTER	370,000 LBS/DAY
AVERAGE (CALCULATED)	148,750 LBS/DAY

BOILER TRIM CONTROL REDUCES EXCESS AIR TO 15%

FROM "GAS COMBUSTION EFFICIENCY CHART" PUBLISHED BY COOPERATIVE EXTENSION SERVICE, KANSAS STATE UNIVERSITY, MANHATTAN KS.:

15% EXCESS AIR AT 317°F = 84.50% COMBUSTION EFF.

84.50% - 80.50% = 4.00% INCREASE IN COMB. EFF.

ENTHALPY OF STEAM LEAVING BOILERS	1192.4 BTU/LB
ENTHALPY OF CONDENSATE RETURNING TO BOILERS	128 BTU/LB
ENTHALPY DIFFERENCE	1064.4 BTU/LB

148,750 LBS/DAY X 1,064 BTU/LB X 365 DAYS/YR > 0.000001 MBTU/BTU =
57,769 MBTU/YR.

THIS TRANSLATES TO GAS CONSUMPTIONS OF

57,769 / 80.50% = 71,763 MBTU/YR.

AND

57,769 / 84.50% = 68,366 MBTU/YR. WITH O2 TRIM CONTROLS.

SAVINGS

71,763 - 68,366 = 3,397 MBTU/YR.

4.08 X 3,397 = \$13,860 PER YEAR

LIFE CYCLE COST ANALYSIS SUMMARY
 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)
 INSTALLATION & LOCATION: FORT LEAVENWORTH - USDB REGION NOS. 7
 PROJECT NO. & TITLE: 1496
 FISCAL YEAR 1990
 ANALYSIS DATE: 03-28-90

STUDY: USDBAE
 LCCID 1.035
 CENSUS: 2

DISCRETE PORTION NAME: ECOM1502
 ECONOMIC LIFE 15 YEARS
 PREPARED BY: CRB

1. INVESTMENT						
A. CONSTRUCTION COST					\$	36865.
B. SIOH					\$	2212.
C. DESIGN COST					\$	2028.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9					\$	36995.
E. SALVAGE VALUE COST					\$	0.
F. TOTAL INVESTMENT (1D-1E)					\$	36995.

2. ENERGY SAVINGS (+) / COST (-)

ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 12.44	0.	\$ 0.	8.69	0.
B. DIST	\$.00	0.	\$ 0.	12.42	0.
C. RESID	\$.00	0.	\$ 0.	12.21	0.
D. NAT G	\$ 4.08	3397.	\$ 13860.	11.67	161746.
E. COAL	\$.00	0.	\$ 0.	10.36	0.
F. TOTAL		3397.	\$ 13860.		\$ 161746.

3. NON ENERGY SAVINGS(+)/COST(-)

A. ANNUAL RECURRING (+/-)					
(1) DISCOUNT FACTOR (TABLE A)		9.11			\$ 0.
(2) DISCOUNTED SAVING/COST (3A X 3A1)					\$ 0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4)					\$ 0.
D. PROJECT NON ENERGY QUALIFICATION TEST					
(1) 25% MAX NON ENERGY CALC (2F5 X .33)			\$ 53376.		
A IF 3D1 IS = OR > 3C GO TO ITEM 4					
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=					
C IF 3D1B IS = > 1 GO TO ITEM 4					
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY					

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE))					\$ 13860.
5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C)					\$ 161746.
6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)=		4.37			
(IF < 1 PROJECT DOES NOT QUALIFY)					

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 2.67

ENG. FORM 150
1AVC-59

LIFE CYCLE COST ANALYSIS SUMMARY
 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)
 INSTALLATION & LOCATION: FORT LEAVENWORTH - USDB REGION NOS. 7
 PROJECT NO. & TITLE: 1496
 FISCAL YEAR 1990
 ANALYSIS DATE: 12-5-90

STUDY: USDBAE
 LCCID 1.035
 CENSUS: 2

DISCRETE PORTION NAME: GROUP #4
 ECONOMIC LIFE 15 YEARS PREPARED BY: CRB

1. INVESTMENT

A. CONSTRUCTION COST	\$	98342.
B. SIOH	\$	5901.
C. DESIGN COST	\$	5409.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9	\$	98687.
E. SALVAGE VALUE COST	\$	0.
F. TOTAL INVESTMENT (1D-1E)	\$	98687.

2. ENERGY SAVINGS (+) / COST (-)

ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 12.44	0.	\$ 0.	8.69	0.
B. DIST	\$.00	0.	\$ 0.	12.42	0.
C. RESID	\$.00	0.	\$ 0.	12.21	0.
D. NAT G	\$ 4.08	7199.	\$ 29372.	11.67	342771.
E. COAL	\$.00	0.	\$ 0.	10.36	0.
F. TOTAL		7199.	\$ 29372.		\$ 342771.

3. NON ENERGY SAVINGS(+)/COST(-)

A. ANNUAL RECURRING (+/-)	\$	0.
(1) DISCOUNT FACTOR (TABLE A)	9.11	
(2) DISCOUNTED SAVING/COST (3A X 3A1)	\$	0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4)	\$	0.

D. PROJECT NON ENERGY QUALIFICATION TEST

(1) 25% MAX NON ENERGY CALC (2F5 X .33)	\$	113114.
A IF 3D1 IS = OR > 3C GO TO ITEM 4		
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=		
C IF 3D1B IS = > 1 GO TO ITEM 4		
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY		

- FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) \$ 29372.
- TOTAL NET DISCOUNTED SAVINGS (2F5+3C) \$ 342771.
- DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 3.47
(IF < 1 PROJECT DOES NOT QUALIFY)
- SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 3.36

GROUP 5

ENERGY CONSERVATION ANALYSIS
ESOS

PROJECT GROUP		ECO	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS \$	PROJECT COST \$	SIMPLE PAYBACK YRS	SIR
	GROUP 5 Building 475 Repairs						
475	Attic Insulation - Rotunda	ECO-A3	142	\$578	\$4,868	7.96	2.03
475	Exhaust Heat Recovery	ECO-M5	453	\$2,130	\$12,909	6.66	1.76
475C	Air System Repair	ECO-M11	273	\$1,458	\$1,779	1.51	7.83
475D	Air System Repair	ECO-M11	277	\$1,474	\$1,779	1.49	7.83
475F	Air System Repair	ECO-M11	307	\$1,641	\$1,779	1.34	8.68
475G	Air System Repair	ECO-M11	247	\$1,323	\$1,779	1.67	6.99
475A	Lighting Levels - Chapel	ECO-E1	3	\$43	\$213	4.70	2.40
475B	Lighting Levels	ECO-E1	3	\$40	\$213	5.00	2.20
475H	Lighting Levels	ECO-E1	2	\$21	\$213	9.50	1.20
475A	Energy Efficient Lighting	ECO-E2	8	\$100	\$131	1.24	9.00
	GROUP 5 TOTALS		1,715	\$8,808	\$25,663	3.40	3.41
	GROUP 5 FUNDING CATEGORY: PECIP						

ECO-A3

ATTIC INSULATION

ECO-A3 ECONOMIC ANALYSIS

BUILDING NUMBER	STEAM CONSUMPTION			ELECTRIC CONSUMPTION			TOTAL SAVINGS (\$)
	BASE ENERGY (THERMS)	ECO-A3 LOAD (THERMS)	ENERGY SAVINGS (MBTU)	BASE LOAD (KW)	ECO-A3 LOAD (KW)	ENERGY SAVINGS (MBTU)	
463	1,577	1,379	20	83,903	82,814	4	\$127
464	2,195	1,311	88	91,802	86,441	18	\$588
472	15,515	15,241	27	234,490	232,543	7	\$194
475	13,619	12,203	142	58,399	58,386	0	\$578
475E	21,657	21,253	40	611,712	611,617	0	\$169
							\$1,657

LIFE CYCLE COST ANALYSIS SUMMARY
 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)
 INSTALLATION & LOCATION: FORT LEAVENWORTH - USDB REGION NOS. 7
 PROJECT NO. & TITLE: 1496
 FISCAL YEAR 1990 DISCRETE PORTION NAME: 475A3
 ANALYSIS DATE: 03-30-90 ECONOMIC LIFE 25 YEARS

STUDY: USDBAE
 LCCID 1.035
 CENSUS: 2

PREPARED BY: CRB

1. INVESTMENT						
A. CONSTRUCTION COST					\$	4592.
B. SIOH					\$	276.
C. DESIGN COST					\$	253.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9					\$	4609.
E. SALVAGE VALUE COST					\$	0.
F. TOTAL INVESTMENT (1D-1E)					\$	4609.

2. ENERGY SAVINGS (+) / COST (-)

ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 12.44	0.	\$ 0.	11.16	0.
B. DIST	\$.00	0.	\$ 0.	17.19	0.
C. RESID	\$.00	0.	\$ 0.	17.12	0.
D. NAT G	\$ 4.08	142.	\$ 579.	16.15	9351.
E. COAL	\$.00	0.	\$ 0.	13.92	0.
F. TOTAL		142.	\$ 579.		\$ 9351.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)				\$	0.
(1) DISCOUNT FACTOR (TABLE A)		11.65		\$	0.
(2) DISCOUNTED SAVING/COST (3A X 3A1)				\$	0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3Bd4) \$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST

(1) 25% MAX NON ENERGY CALC (2F5 X .33)	\$	3086.
A IF 3D1 IS = OR > 3C GO TO ITEM 4		
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=		_____
C IF 3D1B IS = > 1 GO TO ITEM 4		
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY		

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) \$ 579.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) \$ 9351.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 2.03
 (IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 7.96

ENG. FORM 150
1AVC-59

PREVIOUS EDITION MAY BE USED

GROUP 5 - PAGE 4

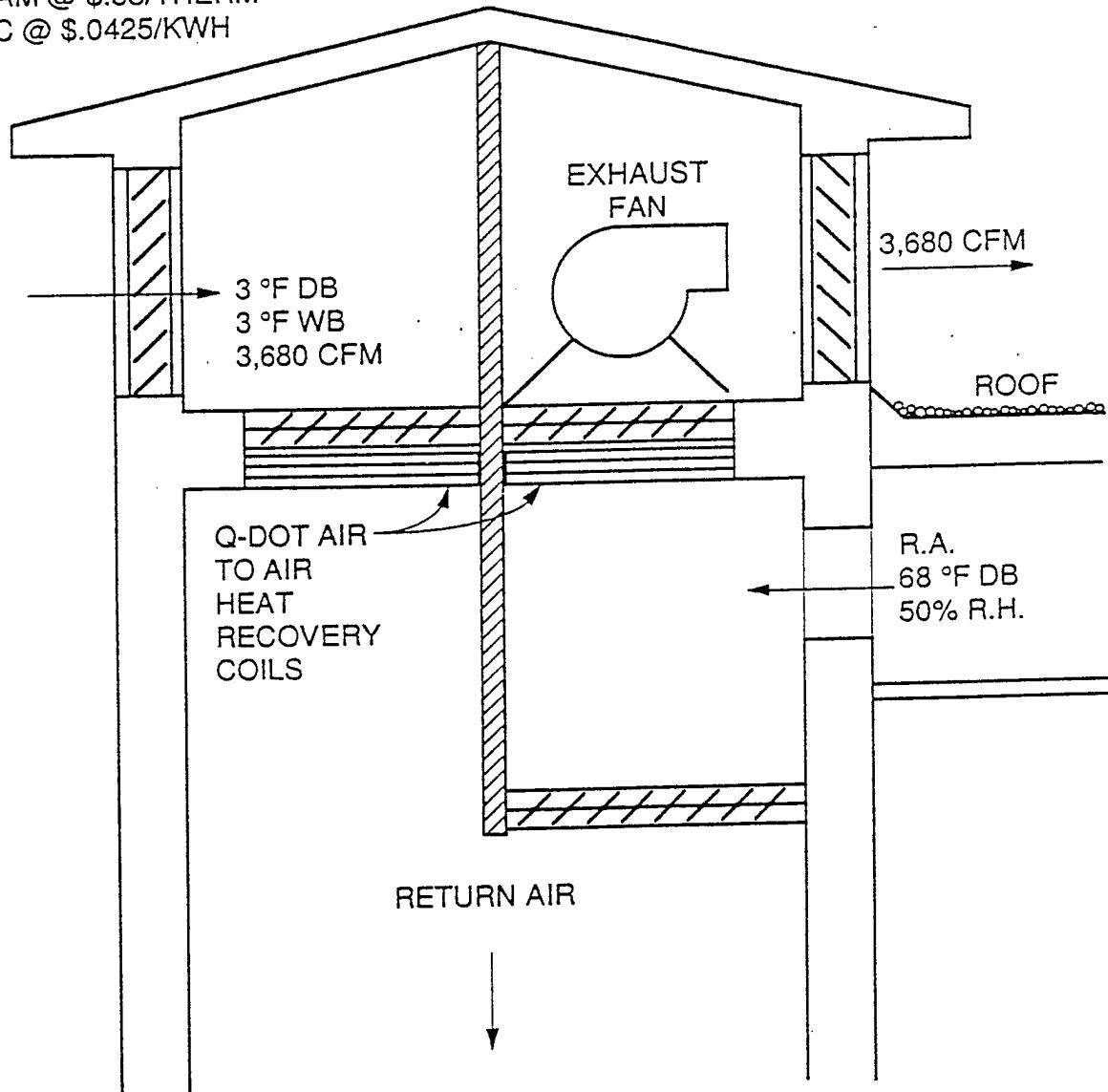
ECO-M5

EXHAUST HEAT RECOVERY

CALCULATION SHEET		DATE Mar-90	SHEET 1	OF OF 1
PROJECT ATION	USDB ENERGY SAVINGS OPPORTUNITY SURVEY FORT LEAVENWORTH, KANSAS	BASIS FOR CALCULATION		
ARCHITECT/ENGINEER	CLARK RICHARDSON & BISKUP	X	HAND COMPUTER CONTRACTOR BID OTHER (SPECIFY)	
ECO MEASURE	ECO-M5: HEAT RECOVERY	COMPUTED BY RGB	CHECKED BY MAW	

OPERATED: 24 HR./DAY, NOVEMBER THROUGH MARCH

STEAM @ \$.53/THERM
ELEC @ \$.0425/KWH



ENG. FORM 150
1AVC-59

PREVIOUS EDITION MAY BE USED

GROUP 5 - PAGE 7

ECO-M11

**CASTLE AIR SYSTEM
REPAIR**

ECO-M11 ECONOMIC ANALYSIS

BUILDING NUMBER	STEAM CONSUMPTION			ELECTRIC CONSUMPTION			TOTAL SAVINGS (\$)
	BASE ENERGY (THERMS)	ECO-M11 LOAD (THERMS)	ENERGY SAVINGS (MBTU)	BASE LOAD (KW)	ECO-M11 LOAD (KW)	ENERGY SAVINGS (MBTU)	
475C	13,472	10,745	273	45,478	45,427	0	\$1,115
475D	15,188	12,422	277	53,358	53,317	0	\$1,130
475F	15,926	12,856	307	53,357	53,324	0	\$1,254
475G	12,853	10,380	247	45,481	45,427	0	\$1,011
							\$4,510

LIFE CYCLE COST ANALYSIS SUMMARY
 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)
 INSTALLATION & LOCATION: FORT LEAVENWORTH - USDB REGION NOS. 7
 PROJECT NO. & TITLE: 1496
 FISCAL YEAR 1990 DISCRETE PORTION NAME: ECOM11C
 ANALYSIS DATE: 03-30-90 ECONOMIC LIFE 15 YEARS PREPARED BY: CRB

STUDY: USDBAE
 LCCID 1.035
 CENSUS: 2

1. INVESTMENT						
A. CONSTRUCTION COST					\$	1678.
B. SIOH					\$	101.
C. DESIGN COST					\$	92.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9					\$	1684.
E. SALVAGE VALUE COST					\$	0.
F. TOTAL INVESTMENT (1D-1E)					\$	1684.

2. ENERGY SAVINGS (+) / COST (-)

ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 12.44	0.	\$ 0.	8.69	0.
B. DIST	\$.00	0.	\$ 0.	12.42	0.
C. RESID	\$.00	0.	\$ 0.	12.21	0.
D. NAT G	\$ 4.08	273.	\$ 1114.	11.67	13000.
E. COAL	\$.00	0.	\$ 0.	10.36	0.
F. TOTAL		273.	\$ 1114.		\$ 13000.

3. NON ENERGY SAVINGS(+)/COST(-)

A. ANNUAL RECURRING (+/-)				\$	0.
(1) DISCOUNT FACTOR (TABLE A)		9.11		\$	0.
(2) DISCOUNTED SAVING/COST (3A X 3A1)				\$	0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST

(1) 25% MAX NON ENERGY CALC (2F5 X .33) \$ 4290.
 A IF 3D1 IS = OR > 3C GO TO ITEM 4
 B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)= _____
 C IF 3D1B IS => 1 GO TO ITEM 4
 D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE))		\$ 1114.
5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C)		\$ 13000.
6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)=	7.72	
(IF < 1 PROJECT DOES NOT QUALIFY)		
7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4	1.51	

LIFE CYCLE COST ANALYSIS SUMMARY
 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)
 INSTALLATION & LOCATION: FORT LEAVENWORTH - USDB REGION NOS. 7
 PROJECT NO. & TITLE: 1496
 FISCAL YEAR 1990 DISCRETE PORTION NAME: ECOM11D
 ANALYSIS DATE: 03-30-90 ECONOMIC LIFE 15 YEARS PREPARED BY: CRB

STUDY: USDBAE
 LCCID 1.035
 CENSUS: 2

1. INVESTMENT						
A. CONSTRUCTION COST					\$	1678.
B. SIOH					\$	101.
C. DESIGN COST					\$	92.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9					\$	1684.
E. SALVAGE VALUE COST					-\$	0.
F. TOTAL INVESTMENT (1D-1E)					\$	1684.

2. ENERGY SAVINGS (+) / COST (-)
 ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 12.44	0.	\$ 0.	8.69	0.
B. DIST	\$.00	0.	\$ 0.	12.42	0.
C. RESID	\$.00	0.	\$ 0.	12.21	0.
D. NAT G	\$ 4.08	277.	\$ 1130.	11.67	13187.
E. COAL	\$.00	0.	\$ 0.	10.36	0.
F. TOTAL		277.	\$ 1130.		\$ 13187.

3. NON ENERGY SAVINGS(+)/COST(-)

A. ANNUAL RECURRING (+/-)					\$	0.
(1) DISCOUNT FACTOR (TABLE A)			9.11		\$	0.
(2) DISCOUNTED SAVING/COST (3A X 3A1)					\$	0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4)					\$	0.
D. PROJECT NON ENERGY QUALIFICATION TEST						
(1) 25% MAX NON ENERGY CALC (2F5 X .33)				\$	4352.	
A IF 3D1 IS = OR > 3C GO TO ITEM 4						
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=						
C IF 3D1B IS = > 1 GO TO ITEM 4						
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY						
4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE))					\$	1130.
5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C)					\$	13187.
6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)=			7.83			
(IF < 1 PROJECT DOES NOT QUALIFY)						
7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4				1.49		

LIFE CYCLE COST ANALYSIS SUMMARY
 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)
 INSTALLATION & LOCATION: FORT LEAVENWORTH - USDB REGION NOS. 7
 STUDY: USDBAE
 PROJECT NO. & TITLE: 1496
 FISCAL YEAR 1990
 ANALYSIS DATE: 03-30-90
 DISCRETE PORTION NAME: ECOM11F
 ECONOMIC LIFE 15 YEARS
 PREPARED BY: CRB
 LCCID 1.035
 CENSUS: 2

1. INVESTMENT						
A. CONSTRUCTION COST					\$	1678.
B. SICOH					\$	101.
C. DESIGN COST					\$	92.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9					\$	1684.
E. SALVAGE VALUE COST					\$	0.
F. TOTAL INVESTMENT (1D-1E)					\$	1684.
2. ENERGY SAVINGS (+) / COST (-)						
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS						
FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)	
A. ELECT	\$ 12.44	0.	\$ 0.	8.69		0.
B. DIST	\$.00	0.	\$ 0.	12.42		0.
C. RESID	\$.00	0.	\$ 0.	12.21		0.
D. NAT G	\$ 4.08	307.	\$ 1253.	11.67		14623.
E. COAL	\$.00	0.	\$ 0.	10.36		0.
F. TOTAL		307.	\$ 1253.		\$	14623.
3. NON ENERGY SAVINGS(+) / COST(-)						
A. ANNUAL RECURRING (+/-)					\$	0.
(1) DISCOUNT FACTOR (TABLE A)			9.11		\$	0.
(2) DISCOUNTED SAVING/COST (3A X 3A1)					\$	0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) / COST(-) (3A2+3Bd4)					\$	0.
D. PROJECT NON ENERGY QUALIFICATION TEST						
(1) 25% MAX NON ENERGY CALC (2F5 X .33)				\$ 4826.		
A IF 3D1 IS = OR > 3C GO TO ITEM 4						
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=						
C IF 3D1B IS = > 1 GO TO ITEM 4						
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY						
4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE))					\$	1253.
5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C)					\$	14623.
6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)=			8.68			
(IF < 1 PROJECT DOES NOT QUALIFY)						
7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4				1.34		

LIFE CYCLE COST ANALYSIS SUMMARY
 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)
 INSTALLATION & LOCATION: FORT LEAVENWORTH - USDB REGION NOS. 7
 PROJECT NO. & TITLE: 1496
 FISCAL YEAR 1990
 ANALYSIS DATE: 03-30-90

STUDY: USDBAE
 LCCID 1.035
 CENSUS: 2

DISCRETE PORTION NAME: ECOM11G

ECONOMIC LIFE 15 YEARS

PREPARED BY: CRB

1. INVESTMENT

A. CONSTRUCTION COST	\$	1678.
B. SIOH	\$	101.
C. DESIGN COST	\$	92.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9	\$	1684.
E. SALVAGE VALUE COST	\$	0.
F. TOTAL INVESTMENT (1D-1E)	\$	1684.

2. ENERGY SAVINGS (+) / COST (-)

ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 12.44	0.	\$ 0.	8.69	0.
B. DIST	\$.00	0.	\$ 0.	12.42	0.
C. RESID	\$.00	0.	\$ 0.	12.21	0.
D. NAT G	\$ 4.08	247.	\$ 1008.	11.67	11763.
E. COAL	\$.00	0.	\$ 0.	10.36	0.
F. TOTAL		247.	\$ 1008.		\$ 11763.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)	\$	0.
(1) DISCOUNT FACTOR (TABLE A)	9.11	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3Bd4)		\$ 0.
D. PROJECT NON ENERGY QUALIFICATION TEST		
(1) 25% MAX NON ENERGY CALC (2F5 X .33)	\$	3882.
A IF 3D1 IS = OR > 3C GO TO ITEM 4		
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=		_____
C IF 3D1B IS = > 1 GO TO ITEM 4		
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY		
4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE))	\$	1008.
5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C)	\$	11763.
6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)=	6.99	
7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4		1.67

ENG. FORM 150
1AVC-59

PREVIOUS EDITION MAY BE USED

GROUP 5 - PAGE 13

ECO-E1

LIGHTING LEVELS

CALCULATION SHEET			DATE Mar-90	SHEET 1	OF 1
PROJECT LOCATION ARCHITECT/ENGINEER ECO MEASURE	USDB ENERGY SAVINGS OPPORTUNITY SURVEY FORT LEAVENWORTH, KS CLARK RICHARDSON & BISKUP ECO-E1	BASIS FOR CALCULATION <input checked="" type="checkbox"/> HAND <input type="checkbox"/> COMPUTER <input type="checkbox"/> CONTRACTOR BID <input type="checkbox"/> OTHER (SPECIFY)			
			COMPUTED BY DJG	CHECKED BY MAW	

BASED ON THE FOLLOWING INFORMATION:
 \$200.62 FOR TYPICAL MOTION SENSOR INSTALLATION
 \$0.0425 PER KWH ELECTRICITY COST
 11.16 25-YEAR DISCOUNT FACTOR

BUILDING # AND ROOM TYPE	LIGHTING WATTS	ANNUAL NORMAL HOURS	ANNUAL HOURS SAVED	ANNUAL KWH SAVED	ANNUAL SAVINGS	PAYOUT IN YEARS	SIR
450 CONFERENCE ROOM	1280	2080	624	799	\$33.96	5.9	1.9
475A CONFERENCE ROOM	640	2080	624	399	\$16.96	11.8	0.9
475A CHAPEL	1620	2080	624	1011	\$42.97	4.7	2.4
475E CONFERENCE ROOM	480	2080	624	300	\$12.75	15.7	0.7
475B CHAPEL	1500	2080	624	936	\$39.78	5.0	2.2
475H CHAPEL	800	2080	624	499	\$21.21	9.5	1.2
TOTAL (SIR >1)	5200	2080	624	3245	\$137.91	8.7	1.3

CALCULATION SHEET		DATE Oct-90	SHEET 1	OF 1
PROJECT	USDB ENERGY SAVINGS OPPORTUNITY SURVEY	BASIS FOR CALCULATION		
LOCATION	FORT LEAVENWORTH, KS	X	HAND COMPUTER CONTRACTOR BID OTHER (SPECIFY)	
ARCHITECT/ENGINEER	CLARK RICHARDSON & BISKUP			
ECO MEASURE	ECO-E1	COMPUTED BY DJG	CHECKED BY MAW	

AVERAGE PAYBACK TIME FOR REPLACING EXISTING SWITCHES
WITH INFRARED MOTION SENSORS FOR VARIOUS SPACES

ALL COSTS ARE BASED ON MEANS CONSTRUCTION/DEMOLITION COST DATA
ELECTRICITY COST FOR FORT LEAVENWORTH USDB IS \$0.0425 PER KWH

MOTION SENSOR INSTALLATION COST

DEMO EXISTING SWITCH BOX	\$2.66
DEMO 8' EMT WITH WIRING	\$5.76
INSTALL 20', 3/4" EMT	\$53.60
INSTALL 40', #12 CONDUCTORS	\$13.60
INSTALL MOTION SENSOR	<u>\$125.00</u>
TOTAL COST PER INSTALLATION	\$200.62

POSSIBLE ENERGY SAVINGS FOR TYPICAL CONFERENCE ROOM

LIGHTING LOAD	720 WATTS
ANNUAL LIGHTING TIME	2080 HOURS
ANNUAL COST @ \$0.0425 PER KWH	\$63.65
ANNUAL SAVINGS IF LIGHTS ARE OFF 30% OF TIME	\$19.10
COST OF INSTALLATION	\$200.62
PAYBACK TIME	10.5 YEARS

POSSIBLE ENERGY SAVINGS FOR TYPICAL SMALL OFFICE ROOM

LIGHTING LOAD	320 WATTS
ANNUAL LIGHTING TIME	2080 HOURS
ANNUAL COST @ \$0.0425 PER KWH	\$28.29
ANNUAL SAVINGS IF LIGHTS ARE OFF 25% OF TIME	\$7.07
COST OF INSTALLATION	\$200.62
PAYBACK TIME	28.4 YEARS

NOTE: SAVINGS ARE VERY DEPENDENT ON SEVERAL ITEMS, WHICH INCLUDE THE FOLLOWING:

- 1) CURRENT PRACTICES IN SWITCHING LIGHTS OFF. IF PEOPLE NORMALLY TURN LIGHTS OFF WHEN NOT IN USE, ENERGY SAVINGS WILL BE MINIMAL.
- 2) AMOUNT OF TIME THAT LIGHTS WILL NOT BE IN USE. THE ABOVE ESTIMATES MAY VARY AND ACTUAL SAVINGS WILL FLUCTUATE ACCORDINGLY.

LIFE CYCLE COST ANALYSIS SUMMARY

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

STUDY: USDBAE

LCCID 1.035

INSTALLATION & LOCATION: FORT LEAVENWORTH - USDB REGION NOS. 7

CENSUS: 2

PROJECT NO. & TITLE: 1496

DISCRETE PORTION NAME: ECOE1

FISCAL YEAR 1990

ECONOMIC LIFE 25 YEARS

PREPARED BY: CRB

ANALYSIS DATE: 03-30-90

1. INVESTMENT

A. CONSTRUCTION COST	\$	802.
B. SIOH	\$	48.
C. DESIGN COST	\$	44.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9	\$	805.
E. SALVAGE VALUE COST	\$	0.
F. TOTAL INVESTMENT (1D-1E)	\$	805.

2. ENERGY SAVINGS (+) / COST (-)

ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 12.44	11.	\$ 137.	11.16	1529.
B. DIST	\$.00	0.	\$ 0.	17.19	0.
C. RESID	\$.00	0.	\$ 0.	17.12	0.
D. NAT G	\$ 4.08	0.	\$ 0.	16.15	0.
E. COAL	\$.00	0.	\$ 0.	13.92	0.
F. TOTAL		11.	\$ 137.		\$ 1529.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)	\$	0.
(1) DISCOUNT FACTOR (TABLE A)	11.65	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3Bd4)	\$	0.
D. PROJECT NON ENERGY QUALIFICATION TEST		

(1) 25% MAX NON ENERGY CALC (2F5 X .33) \$ 505.
 A IF 3D1 IS = OR > 3C GO TO ITEM 4
 B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)= _____
 C IF 3D1B IS = > 1 GO TO ITEM 4
 D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE))	\$	137.
5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C)	\$	1529.
6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)=	1.90	
(IF < 1 PROJECT DOES NOT QUALIFY)		
7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4		5.88

ECO-E2

**ENERGY EFFICIENT
LIGHTING SYSTEMS**

CALCULATION SHEET		DATE Mar-90	SHEET 1	OF 1
PROJECT USDB ENERGY SAVINGS OPPORTUNITY SURVEY		BASIS FOR CALCULATION		
LOCATION FORT LEAVENWORTH, KS		X	HAND COMPUTER CONTRACTOR BID OTHER (SPECIFY)	
ARCHITECT/ENGINEER CLARK RICHARDSON & BISKUP		COMPUTED BY DJG		
ECO MEASURE ECO-E2		CHECKED BY MAW		

AVERAGE PAYBACK TIME FOR RELAMPING AND REBALLASTING FLUORESCENT LIGHT FIXTURES

ALL COSTS ARE BASED ON MEANS CONSTRUCTION/DEMOLITION COST DATA

ELECTRICITY COST FOR FORT LEAVENWORTH USDB IS \$0.0425 PER KWH

ASSUME FIXTURES ARE ON FOR 365 DAYS x 12 HOURS PER DAY = 4380 HOURS PER YEAR

2 LAMP FLUORESCENT LIGHT FIXTURE

COST TO REBALLAST LIGHT FIXTURE	\$58.00
COST TO RELAMP LIGHT FIXTURE WITH 34W LAMPS \$9.25 x 2 =	\$18.50
TOTAL COST PER FIXTURE	\$76.50

<u>ELECTRICITY SAVINGS</u>	
8W PER LAMP x 2 LAMPS PER FIXTURE	= 16W PER FIXTURE PER HOUR
\$0.0425 PER KWH x 0.016 KWH x 4380 HRS	= 0.016 KWH PER FIXTURE
	= \$2.98 PER YEAR

<u>SIMPLE PAYBACK</u>	
TOTAL COST PER FIXTURE	\$76.50
ELECTRICITY SAVINGS PER YEAR	\$2.98
SIMPLE PAYBACK IN YEARS	25.7

4 LAMP FLUORESCENT LIGHT FIXTURE

COST TO REBALLAST LIGHT FIXTURE	\$58.00 x 2 =	\$116.00
COST TO RELAMP LIGHT FIXTURE WITH 34W LAMPS \$9.25 x 4 =	\$37.00	
TOTAL COST PER FIXTURE	\$153.00	

<u>ELECTRICITY SAVINGS</u>	
8W PER LAMP x 4 LAMPS PER FIXTURE	= 32W PER FIXTURE PER HOUR
\$0.0425 PER KWH x 0.032 KWH x 4380 HRS	= 0.032 KWH PER FIXTURE
	= \$5.97 PER YEAR

<u>SIMPLE PAYBACK</u>	
TOTAL COST PER FIXTURE	\$153.00
ELECTRICITY SAVINGS PER YEAR	\$5.97
SIMPLE PAYBACK IN YEARS	25.6

CALCULATION SHEET		DATE Mar-90	SHEET 1	OF 1
PROJECT	USDB ENERGY SAVINGS OPPORTUNITY SURVEY	BASIS FOR CALCULATION		
LOCATION	FORT LEAVENWORTH, KS	X	HAND COMPUTER CONTRACTOR BID OTHER (SPECIFY)	
ARCHITECT/ENGINEER	CLARK RICHARDSON & BISKUP			
ECO MEASURE	ECO-E2	COMPUTED BY DJG	CHECKED BY MAW	

CALCULATIONS FOR RETROFITTING INCANDESCENT FIXTURES TO FLUORESCENT FIXTURES
BUILDING 475A STAIRWELL

ALL COSTS ARE BASED ON MEANS CONSTRUCTION/DEMOLITION COST DATA

ELECTRICITY COST FOR FORT LEAVENWORTH USDB IS \$0.0425 PER KWH

ASSUME FIXTURES ARE ON FOR 365 DAYS x 24 HOURS PER DAY = 8760 HOURS PER YEAR

DESCRIPTION	NUMBER (EACH)	INSTALLED COST	TOTAL COST	ENERGY USE (W)	TOTAL ENERGY USE
ADAPTER BALLAST	6	\$11.00	\$66	3	18
13W DOUBLE TWIN TUBE FLUORESCENT LAMP	6	\$5.84	\$35	13	78
LABOR	6	\$3.75	\$23	0	0
TOTAL			\$124		0.096KW

EXISTING ELECTRICITY USAGE = 6 LAMPS x 60W PER LAMP = 360 W OR .36KW/H

NEW ELECTRICITY USAGE = 0.096 KW/H

TOTAL ELECTRICITY SAVED = 0.36 KW/H - 0.096 KW/H = 0.264 KW/H

YEARLY SAVINGS = 0.264 KW/H x \$0.0425 /KWH x 8760 HOURS/YEAR = \$98.29 PER YEAR

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FORT LEAVENWORTH - USDB REGION NOS. 7

PROJECT NO. & TITLE: 1496

FISCAL YEAR 1990 DISCRETE PORTION NAME: ECOE2

ANALYSIS DATE: 03-23-90

ECONOMIC LIFE 25 YEARS

STUDY: USDBAE

LCCID 1.035

CENSUS: 2

PREPARED BY: CRB

1. INVESTMENT

A. CONSTRUCTION COST	\$	124.
B. SIOH	\$	7.
C. DESIGN COST	\$	7.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9	\$	124.
E. SALVAGE VALUE COST	\$	0.
F. TOTAL INVESTMENT (1D-1E)	\$	124.

2. ENERGY SAVINGS (+) / COST (-)

ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 12.44	8.	\$ 100.	11.16	1116.
B. DIST	\$.00	0.	\$ 0.	17.19	0.
C. RESID	\$.00	0.	\$ 0.	17.12	0.
D. NAT G	\$ 4.08	0.	\$ 0.	16.15	0.
E. COAL	\$.00	0.	\$ 0.	13.92	0.
F. TOTAL		8.	\$ 100.		\$ 1116.

3. NON ENERGY SAVINGS(+)/COST(-)

A. ANNUAL RECURRING (+/-)	\$	0.
(1) DISCOUNT FACTOR (TABLE A)	11.65	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST

(1) 25% MAX NON ENERGY CALC (2F5 X .33) \$ 368.

A IF 3D1 IS = OR > 3C GO TO ITEM 4

B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F=

C IF 3D1B IS = > 1 GO TO ITEM 4

D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) \$ 100.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) \$ 1116.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 9.00
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 1.24

LIFE CYCLE COST ANALYSIS SUMMARY
 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)
 INSTALLATION & LOCATION: FORT LEAVENWORTH - USDB REGION NOS. 7
 PROJECT NO. & TITLE: 1496
 FISCAL YEAR 1990 DISCRETE PORTION NAME: GROUP #5
 ANALYSIS DATE: 12-5-90 ECONOMIC LIFE 15 YEARS PREPARED BY: CRB

STUDY: USDBAE
 LCCID 1.035
 CENSUS: 2

1. INVESTMENT						
A. CONSTRUCTION COST					\$	24206.
B. SIOH					\$	1452.
C. DESIGN COST					\$	1331.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9					\$	24290.
E. SALVAGE VALUE COST					-\$	0.
F. TOTAL INVESTMENT (1D-1E)					\$	24290.

2. ENERGY SAVINGS (+) / COST (-)

ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 12.44	17.	\$ 211.	8.69	1834.
B. DIST	\$.00	0..	\$ 0.	12.42	0.
C. RESID	\$.00	0.	\$ 0.	12.21	0.
D. NAT G	\$ 4.08	1699.	\$ 6932.	11.67	80896.
E. COAL	\$.00	0.	\$ 0.	10.36	0.
F. TOTAL		1716.	\$ 7143.		\$ 82730.

3. NON ENERGY SAVINGS(+)/COST(-)

A. ANNUAL RECURRING (+/-)				\$	0.
(1) DISCOUNT FACTOR (TABLE A)		9.11		\$	0.
(2) DISCOUNTED SAVING/COST (3A X 3A1)				\$	0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4)				\$	0.
D. PROJECT NON ENERGY QUALIFICATION TEST					
(1) 25% MAX NON ENERGY CALC (2F5 X .33)			\$	27301.	
A IF 3D1 IS = OR > 3C GO TO ITEM 4					
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=					
C IF 3D1B IS = > 1 GO TO ITEM 4					
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY					

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE))		\$	7143.
5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C)		\$	82730.
6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)=	3.41		
(IF < 1 PROJECT DOES NOT QUALIFY)			
7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4		3.40	

GROUP 6

ENERGY CONSERVATION ANALYSIS ESOS

PROJECT GROUP	ECO	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS \$	PROJECT COST \$	SIMPLE PAYBACK YRS	SIR	
	GROUP 6 Building 450 Repairs						
450	Solar Window Shading	ECO-A6	36	\$256	\$2,121	7.84	1.66
450	Lighting Levels	ECO-E1	3	\$34	\$213	5.90	1.90
	GROUP 6 TOTALS		39	\$290	\$2,334	7.58	1.27
	GROUP 6 FUNDING CATEGORY: LOW COST/NO COST						

ECO-A6

SOLAR WINDOW SHADING

ECO-A6 ECONOMIC ANALYSIS

BUILDING NUMBER	STEAM CONSUMPTION			ELECTRIC CONSUMPTION			TOTAL SAVINGS (\$)
	BASE ENERGY (THERMS)	ECO-A6 LOAD (THERMS)	ENERGY SAVINGS (MBTU)	BASE LOAD (KW)	ECO-A6 LOAD (KW)	ENERGY SAVINGS (MBTU)	
450	3,629	2,920	71	135,466	132,697	9	\$407
463	1,577	1,796	-22	83,903	82,425	5	(\$27)
464	2,195	2,352	-16	91,802	90,467	5	(\$7)
472	15,515	15,515	0	234,490	229,344	18	\$218
473	2,407	2,609	-20	148,420	145,653	9	\$35
475A	12,773	12,773	0	146,357	136,920	32	\$401
475B	8,477	8,477	0	95,207	93,496	6	\$73
475H	8,137	8,137	0	87,858	86,474	5	\$59
							\$751

LIFE CYCLE COST ANALYSIS SUMMARY
 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)
 INSTALLATION & LOCATION: FORT LEAVENWORTH - USDB REGION NOS. 7
 PROJECT NO. & TITLE: 1496
 FISCAL YEAR 1990 DISCRETE PORTION NAME: 450A6
 ANALYSIS DATE: 03-30-90 ECONOMIC LIFE 25 YEARS

STUDY: USDBAE
 LCCID 1.035
 CENSUS: 2

PREPARED BY: CRB

1. INVESTMENT

A. CONSTRUCTION COST	\$	2001.
B. SIOH	\$	120.
C. DESIGN COST	\$	110.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9	\$	2008.
E. SALVAGE VALUE COST	\$	0.
F. TOTAL INVESTMENT (1D-1E)	\$	2008.

2. ENERGY SAVINGS (+) / COST (-)

ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 12.44	13.	\$ 162.	11.16	1808.
B. DIST	\$.00	0.	\$ 0.	17.19	0.
C. RESID	\$.00	0.	\$ 0.	17.12	0.
D. NAT G	\$ 4.08	23.	\$ 94.	16.15	1518.
E. COAL	\$.00	0.	\$ 0.	13.92	0.
F. TOTAL		36.	\$ 256.		\$ 3326.

3. NON ENERGY SAVINGS(+)/COST(-)

A. ANNUAL RECURRING (+/-)	\$	0.
(1) DISCOUNT FACTOR (TABLE A)	11.65	
(2) DISCOUNTED SAVING/COST (3A X 3A1)	\$	0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4)	\$	0.
D. PROJECT NON ENERGY QUALIFICATION TEST		
(1) 25% MAX NON ENERGY CALC (2F5 X .33)	\$	1098.
A IF 3D1 IS = OR > 3C GO TO ITEM 4		
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=		
C IF 3D1B IS = > 1 GO TO ITEM 4		
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY		

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE))	\$	256.
5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C)	\$	3326.
6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)=	1.66	
7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4		7.84

ENG. FORM 150
1AVG-59

ECO-E1

LIGHTING LEVELS

CALCULATION SHEET		DATE Mar-90	SHEET 1	OF 1
PROJECT	USDB ENERGY SAVINGS OPPORTUNITY SURVEY	BASIS FOR CALCULATION		
LOCATION	FORT LEAVENWORTH, KS			
ARCHITECT/ENGINEER	CLARK RICHARDSON & BISKUP			
ECO MEASURE	ECO-E1	COMPUTED BY DJG	CHECKED BY MAW	

BASED ON THE FOLLOWING INFORMATION:
 \$200.62 FOR TYPICAL MOTION SENSOR INSTALLATION
 \$0.0425 PER KWH ELECTRICITY COST
 11.16 25-YEAR DISCOUNT FACTOR

BUILDING # AND ROOM TYPE	LIGHTING WATTS	ANNUAL NORMAL HOURS	ANNUAL HOURS SAVED	ANNUAL KWH SAVED	ANNUAL SAVINGS	PAYBACK IN YEARS	SIR
450 CONFERENCE ROOM	1280	2080	624	799	\$33.96	5.9	1.9
475A CONFERENCE ROOM	640	2080	624	399	\$16.96	11.8	0.9
475A CHAPEL	1620	2080	624	1011	\$42.97	4.7	2.4
475E CONFERENCE ROOM	480	2080	624	300	\$12.75	15.7	0.7
475B CHAPEL	1500	2080	624	936	\$39.78	5.0	2.2
475H CHAPEL	800	2080	624	499	\$21.21	9.5	1.2
TOTAL (SIR >1)	5200	2080	624	3245	\$137.91	8.7	1.3

CALCULATION SHEET		DATE Oct-90	SHEET 1	OF 1
PROJECT	USDB ENERGY SAVINGS OPPORTUNITY SURVEY			
LOCATION	FORT LEAVENWORTH, KS			
ARCHITECT/ENGINEER	CLARK RICHARDSON & BISKUP			
ECO MEASURE	ECO-E1 <u>AVERAGE PAYBACK TIME FOR REPLACING EXISTING SWITCHES WITH INFRARED MOTION SENSORS FOR VARIOUS SPACES</u>			
COMPUTED BY DJG	CHECKED BY MAW			

ALL COSTS ARE BASED ON MEANS CONSTRUCTION/DEMOLITION COST DATA
ELECTRICITY COST FOR FORT LEAVENWORTH USDB IS \$0.0425 PER KWH

MOTION SENSOR INSTALLATION COST

DEMO EXISTING SWITCH BOX	\$2.66
DEMO 8' EMT WITH WIRING	\$5.76
INSTALL 20', 3/4" EMT	\$53.60
INSTALL 40', #12 CONDUCTORS	\$13.60
INSTALL MOTION SENSOR	\$125.00
TOTAL COST PER INSTALLATION	<u>\$200.62</u>

POSSIBLE ENERGY SAVINGS FOR TYPICAL CONFERENCE ROOM

LIGHTING LOAD	720 WATTS
ANNUAL LIGHTING TIME	2080 HOURS
ANNUAL COST @ \$0.0425 PER KWH	\$63.65
ANNUAL SAVINGS IF LIGHTS ARE OFF 30% OF TIME	\$19.10
COST OF INSTALLATION	\$200.62
PAYBACK TIME	10.5 YEARS

POSSIBLE ENERGY SAVINGS FOR TYPICAL SMALL OFFICE ROOM

LIGHTING LOAD	320 WATTS
ANNUAL LIGHTING TIME	2080 HOURS
ANNUAL COST @ \$0.0425 PER KWH	\$28.29
ANNUAL SAVINGS IF LIGHTS ARE OFF 25% OF TIME	\$7.07
COST OF INSTALLATION	\$200.62
PAYBACK TIME	28.4 YEARS

NOTE: SAVINGS ARE VERY DEPENDENT ON SEVERAL ITEMS, WHICH INCLUDE THE FOLLOWING:
1) CURRENT PRACTICES IN SWITCHING LIGHTS OFF. IF PEOPLE NORMALLY TURN LIGHTS OFF WHEN NOT

IN USE, ENERGY SAVINGS WILL BE MINIMAL.

2) AMOUNT OF TIME THAT LIGHTS WILL NOT BE IN USE. THE ABOVE ESTIMATES MAY VARY

AND ACTUAL SAVINGS WILL FLUCTUATE ACCORDINGLY.

LIFE CYCLE COST ANALYSIS SUMMARY
 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)
 INSTALLATION & LOCATION: FORT LEAVENWORTH - USDB REGION NOS. 7
 PROJECT NO. & TITLE: 1496
 FISCAL YEAR 1990
 ANALYSIS DATE: 03-30-90

STUDY: USDBAE
 LCCID 1.035
 CENSUS: 2

DISCRETE PORTION NAME: ECOE1
 ECONOMIC LIFE 25 YEARS
 PREPARED BY: CRB

1. INVESTMENT						
A. CONSTRUCTION COST					\$	802.
B. SIOH					\$	48.
C. DESIGN COST					\$	44.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9					\$	805.
E. SALVAGE VALUE COST					\$	0.
F. TOTAL INVESTMENT (1D-1E)					\$	805.

2. ENERGY SAVINGS (+) / COST (-)
 ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 12.44	11.	\$ 137.	11.16	1529.
B. DIST	\$.00	0.	\$ 0.	17.19	0.
C. RESID	\$.00	0.	\$ 0.	17.12	0.
D. NAT G	\$ 4.08	0.	\$ 0.	16.15	0.
E. COAL	\$.00	0.	\$ 0.	13.92	0.
F. TOTAL		11.	\$ 137.		\$ 1529.

3. NON ENERGY SAVINGS(+)/COST(-)						
A. ANNUAL RECURRING (+/-)					\$	0.
(1) DISCOUNT FACTOR (TABLE A)			11.65		\$	0.
(2) DISCOUNTED SAVING/COST (3A X 3A1)					\$	0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4)					\$	0.
D. PROJECT NON ENERGY QUALIFICATION TEST						
(1) 25% MAX NON ENERGY CALC (2F5 X .33)				\$	505.	
A IF 3D1 IS = OR > 3C GO TO ITEM 4						
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=						
C IF 3D1B IS = > 1 GO TO ITEM 4						
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY						
4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE))					\$	137.
5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C)					\$	1529.
6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)=			1.90			
(IF < 1 PROJECT DOES NOT QUALIFY)						
7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4						5.88

LIFE CYCLE COST ANALYSIS SUMMARY
 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)
 INSTALLATION & LOCATION: FORT LEAVENWORTH - USDB REGION NOS. 7
 PROJECT NO. & TITLE: 1496
 FISCAL YEAR 1990
 ANALYSIS DATE: 12-5-90

STUDY: USDBAE
 LCCID 1.035
 CENSUS: 2

DISCRETE PORTION NAME: GROUP #6
 ECONOMIC LIFE 15 YEARS PREPARED BY: CRB

1. INVESTMENT						
A. CONSTRUCTION COST					\$	2214.
B. SIOH					\$	133.
C. DESIGN COST					\$	122.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9					\$	2222.
E. SALVAGE VALUE COST					\$	0.
F. TOTAL INVESTMENT (1D-1E)					\$	2222.

2. ENERGY SAVINGS (+) / COST (-)

ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 12.44	16.	\$ 199.	8.69	1729.
B. DIST	\$.00.	0.	\$ 0.	12.42	0.
C. RESID	\$.00	0.	\$ 0.	12.21	0.
D. NAT G	\$ 4.08	23.	\$ 94.	11.67	1097.
E. COAL	\$.00	0.	\$ 0.	10.36	0.
F. TOTAL		39.	\$ 293.		\$ 2826.

3. NON ENERGY SAVINGS(+)/COST(-)

A. ANNUAL RECURRING (+/-)				\$	0.
(1) DISCOUNT FACTOR (TABLE A)		9.11		\$	0.
(2) DISCOUNTED SAVING/COST (3A X 3A1)				\$	0.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4)				\$	0.
D. PROJECT NON ENERGY QUALIFICATION TEST					
(1) 25% MAX NON ENERGY CALC (2F5 X .33)			\$ 933.		
A IF 3D1 IS = OR > 3C GO TO ITEM 4					
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=					
C IF 3D1B IS = > 1 GO TO ITEM 4					
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY					

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE))		\$	293.
5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C)		\$	2826.
6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)=	1.27		
(IF < 1 PROJECT DOES NOT QUALIFY)			

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 7.58

GROUP 7

ENERGY CONSERVATION ANALYSIS
ESOS

PROJECT GROUP	ECO	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS \$	PROJECT COST \$	SIMPLE PAYBACK YRS	SIR
GROUP 7 Energy Efficient Motors						
All Buildings in the USDB	ECO-E3	248	\$3,085	\$22,185	6.81	1.64
GROUP 7 TOTALS		248	\$3,085	\$22,185	6.81	1.64
GROUP 7 FUNDING CATEGORY: NONE						

ECO-E3

ENERGY EFFICIENT MOTORS

**AVERAGE EFFICIENCIES AND ENERGY SAVINGS FOR
VARIOUS MOTOR SIZES
STANDARD VS HIGH EFFICIENCY
PAYBACKS FOR REPLACING AN EXISTING MOTOR**

HORSE-POWER	STANDARD MOTOR EFFICIENCY	HI EFF MOTOR EFFICIENCY	STANDARD MOTOR WATT LOSS	HI EFF MOTOR WATT LOSS	WATT LOSS DIFFERENCE	INSTALLED HI EFF MTR COST
1	76.5	84.0	229	142	87	\$420
1.5	78.5	85.5	306	190	117	\$442
2	80.8	86.5	355	233	122	\$466
3	79.9	88.5	563	291	272	\$582
5	83.1	89.5	759	438	321	\$644
7.5	83.8	90.2	1082	608	474	\$820
10	85.0	90.2	1316	811	506	\$966
15	86.5	91.7	1746	1013	734	\$1,255
20	87.5	93.0	2131	1123	1008	\$1,527
25	88.0	93.0	2543	1404	1139	\$1,780
30	88.1	93.0	3023	1685	1338	\$2,030
40	89.4	93.6	3538	2040	1498	\$2,623
50	90.4	94.1	3961	2339	1622	\$3,232

HORSE-POWER	8760 HOURS				5000 HOURS			
	ENERGY SAVINGS	COST SAVINGS	SIMPLE PAYBACK	SIR	ENERGY SAVINGS	COST SAVINGS	SIMPLE PAYBACK	SIR
1	763	\$32	13.0	0.9	435	\$19	22.7	0.5
1.5	1,022	\$43	10.2	1.1	584	\$25	17.8	0.6
2	1,066	\$45	10.3	1.1	608	\$26	18.0	0.6
3	2,384	\$101	5.7	1.9	1,361	\$58	10.1	1.1
5	2,812	\$119	5.4	2.0	1,605	\$68	9.4	1.2
7.5	4,150	\$176	4.6	2.4	2,369	\$101	8.1	1.4
10	4,432	\$188	5.1	2.2	2,530	\$108	9.0	1.2
15	6,426	\$273	4.6	2.4	3,668	\$156	8.1	1.4
20	8,834	\$375	4.1	2.7	5,042	\$214	7.1	1.5
25	9,981	\$424	4.2	2.6	5,697	\$242	7.4	1.5
30	11,725	\$498	4.1	2.7	6,692	\$284	7.1	1.5
40	13,120	\$558	4.7	2.3	7,489	\$318	8.2	1.3
50	14,212	\$604	5.4	2.1	8,112	\$345	9.4	1.2

HORSE-POWER	4380 HOURS				2920 HOURS			
	ENERGY SAVINGS	COST SAVINGS	SIMPLE PAYBACK	SIR	ENERGY SAVINGS	COST SAVINGS	SIMPLE PAYBACK	SIR
1	381	\$16	25.9	0.4	254	\$11	38.9	0.3
1.5	511	\$22	20.3	0.5	341	\$14	30.5	0.4
2	533	\$23	20.6	0.5	355	\$15	30.9	0.4
3	1,192	\$51	11.5	1.0	795	\$34	17.2	0.6
5	1,406	\$60	10.8	1.0	937	\$40	16.2	0.7
7.5	2,075	\$88	9.3	1.2	1,383	\$59	13.9	0.8
10	2,216	\$94	10.3	1.1	1,477	\$63	15.4	0.7
15	3,213	\$137	9.2	1.2	2,142	\$91	13.8	0.8
20	4,417	\$188	8.1	1.4	2,945	\$125	12.2	0.9
25	4,991	\$212	8.4	1.3	3,327	\$141	12.6	0.9
30	5,862	\$249	8.1	1.4	3,908	\$166	12.2	0.9
40	6,560	\$279	9.4	1.2	4,373	\$186	14.1	0.8
50	7,106	\$302	10.7	1.0	4,737	\$201	16.1	0.7

25 YEAR DISCOUNT FACTOR = 11.16

ELECTRICITY COST = 4.25¢/KWH

CALCULATION SHEET				DATE Mar-90	SHEET OF 1 2		
PROJECT	USDB ENERGY SAVINGS OPPORTUNITY SURVEY			BASIS FOR CALCULATION			
LOCATION	FORT LEAVENWORTH, KS			<input checked="" type="checkbox"/> HAND <input type="checkbox"/> COMPUTER <input type="checkbox"/> CONTRACTOR BID <input type="checkbox"/> OTHER (SPECIFY)			
ARCHITECT/ENGINEER	CLARK RICHARDSON & BISKUP			COMPUTED BY DJG		CHECKED BY MAW	
ECO MEASURE	ECO-E3						
BUILDING # AND MOTOR DESCRIPTION	HP	OPER. HOURS/ YEAR	SAVINGS PER YEAR MBTU'S	SAVINGS PER YEAR DOLLARS	INSTALLED COST	SIR	PAYOUT YEARS
BUILDING 463 FAN	1.5	4380	1.7	\$21.15	\$442	0.5	20.9
BUILDING 463 CONDENSING UNIT	5	4380	4.8	\$59.71	\$644	1.0	10.8
BUILDING 464 FAN	1.5	4380	1.7	\$21.15	\$442	0.5	20.9
BUILDING 464 FAN	1.5	4380	1.7	\$21.15	\$442	0.5	20.9
BUILDING 465 COMPRESSOR	5	5000	5.5	\$68.42	\$644	1.2	9.4
BUILDING 465 COMPRESSOR	5	5000	5.5	\$68.42	\$644	1.2	9.4
BUILDING 465 COLD WATER PUMP	1.5	4380	1.7	\$21.15	\$442	0.5	20.9
BUILDING 465 HOT WATER PUMP	7.5	4380	7.1	\$88.32	\$820	1.2	9.3
BUILDING 465 AIR HANDLING UNIT	2	4380	1.8	\$22.39	\$466	0.5	20.8
BUILDING 465 AIR HANDLING UNIT	1	4380	1.3	\$16.17	\$420	0.4	26.0
BUILDING 465 AIR HANDLING UNIT	1	4380	1.3	\$16.17	\$420	0.4	26.0
BUILDING 472 HOT WATER PUMP	3	4380	4.1	\$51.00	\$582	1.0	11.4
BUILDING 472 FAN	1.5	4380	1.7	\$21.15	\$442	0.5	20.9
BUILDING 473 HOT WATER PUMP	3	4380	4.1	\$51.00	\$582	1.0	11.4
BUILDING 473 HOT WATER PUMP	5	4380	4.8	\$59.71	\$644	1.0	10.8
BUILDING 474 BOILER FEED PUMP	40	8760	44.8	\$557.31	\$2,623	2.4	4.7
BUILDING 474 FAN	10	8760	15.1	\$187.84	\$966	2.2	5.1
BUILDING 474 FAN	10	8760	15.1	\$187.84	\$966	2.2	5.1
BUILDING 474 FAN	10	8760	15.1	\$187.84	\$966	2.2	5.1
BUILDING 474 CONDENSATE PUMP	10	8760	15.1	\$187.84	\$966	2.2	5.1
BUILDING 474 CONDENSATE PUMP	10	8760	15.1	\$187.84	\$966	2.2	5.1
BUILDING 474 AIR COMPRESSOR	3	8760	8.1	\$100.76	\$582	1.9	5.8
BUILDING 474 AIR COMPRESSOR	25	8760	34.1	\$424.20	\$1,780	2.7	4.2

25-YEAR DISCOUNT FACTOR = 11.16

CALCULATION SHEET				DATE Mar-90	SHEET OF 2 - 2		
PROJECT	USDB ENERGY SAVINGS OPPORTUNITY SURVEY			BASIS FOR CALCULATION			
LOCATION	FORT LEAVENWORTH, KS						
ARCHITECT/ENGINEER	CLARK RICHARDSON & BISKUP			<input checked="" type="checkbox"/> HAND <input type="checkbox"/> COMPUTER <input type="checkbox"/> CONTRACTOR BID <input type="checkbox"/> OTHER (SPECIFY)			
ECO MEASURE	ECO-E3			COMPUTED BY DJG	CHECKED BY MAW		
BUILDING # AND MOTOR DESCRIPTION	HP	OPER. HOURS/ YEAR	SAVINGS PER YEAR MBTU'S	SAVINGS PER YEAR DOLLARS	INSTALLED COST	SIR	PAYBACK YEARS
BUILDING 475 ROTUNDA CONDENSING UNIT	3	4380	4.1	\$51.00	\$582	1.0	11.4
BUILDING 475 ROTUNDA CONDENSING UNIT	7.5	4380	7.1	\$88.32	\$820	1.2	9.3
BUILDING 475C FAN	5	4380	4.8	\$59.71	\$644	1.0	10.8
BUILDING 475C FAN	5	4380	4.8	\$59.71	\$644	1.0	10.8
BUILDING 475D FAN	5	4380	4.8	\$59.71	\$644	1.0	10.8
BUILDING 475D FAN	5	4380	4.8	\$59.71	\$644	1.0	10.8
BUILDING 475F FAN	5	4380	4.8	\$59.71	\$644	1.0	10.8
BUILDING 475F FAN	5	4380	4.8	\$59.71	\$644	1.0	10.8
BUILDING 475G FAN	5	4380	4.8	\$59.71	\$644	1.0	10.8
BUILDING 475G FAN	5	4380	4.8	\$59.71	\$644	1.0	10.8
TOTAL (SIR > 1)			248	\$3,085.00	\$20,929	1.6	6.8

25-YEAR DISCOUNT FACTOR= 11.16

LIFE CYCLE COST ANALYSIS SUMMARY
 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)
 INSTALLATION & LOCATION: FORT LEAVENWORTH - USDB REGION NOS. 7
 PROJECT NO. & TITLE: 1496
 FISCAL YEAR 1990
 ANALYSIS DATE: 03-19-90

STUDY: USDBAE
 LCCID 1.035
 CENSUS: 2

DISCRETE PORTION NAME: GROUP #7
 ECONOMIC LIFE 15 YEARS PREPARED BY: CRB

1. INVESTMENT						
A. CONSTRUCTION COST					\$	20929.
B. SIOH					\$	1256.
C. DESIGN COST					\$	1151.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9					\$	21002.
E. SALVAGE VALUE COST					\$	0.
F. TOTAL INVESTMENT (1D-1E)					\$	21002.

2. ENERGY SAVINGS (+) / COST (-)

ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 12.44	248.	\$ 3085.	11.16	34429.
B. DIST	\$.00	0.	\$ 0.	17.19	0.
C. RESID	\$.00	0.	\$ 0.	17.12	0.
D. NAT G	\$ 4.08	0.	\$ 0.	16.15	0.
E. COAL	\$.00	0.	\$ 0.	13.92	0.
F. TOTAL		248.	\$ 3085.		\$ 34429.

3. NON ENERGY SAVINGS(+)/COST(-)

A. ANNUAL RECURRING (+/-)				\$	0.
(1) DISCOUNT FACTOR (TABLE A)		9.11		\$	0.
(2) DISCOUNTED SAVING/COST (3A X 3A1)				\$	0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST

(1) 25% MAX NON ENERGY CALC (2F5 X .33) \$ 11362.
 A IF 3D1 IS = OR > 3C GO TO ITEM 4
 B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F= _____
 C IF 3D1B IS = > 1 GO TO ITEM 4
 D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) \$ 3085.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) \$ 34429.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 1.64
 (IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 6.81

FACILITIES ENGINEERING WORK REQUEST - XFA, XFB, XFC & XFD
For use of this form see AR 420-17 and DA Pam 420-5: the procurement agency is the Office of the Chief Civil Engineers.

for use of this form, size A.R. 420-17 and D.A. Form 420-5: the coordinating agency is the Office of the Chief of Engineers.

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DESCRIPTION OF WORK TO BE ACCOMPLISHED
AND ORGANIZATION AND IDENTIFICATION OF WORK TO BE ACCOMPLISHED

Replace existing standard efficiency motors with high efficiency motors, where economically feasible. Use energy efficient motors when replacing motors during regular maintenance. This will result in higher complex power factors at the USDB and less electrical energy consumption.

REQUESTER INFORMATION		PERSON TO CALL FOR ADDITIONAL INFORMATION	
ORGANIZATION	TELEPHONE NO.	NAME	ORGANIZATION
			TELEPHONE

FORWARD FOR APPROVAL		APPROVED FOR DESIGN		SOURCE OF FUNDS
RECOMMENDED ACTION	ENVIRONMENTAL IMPACT	ESTIMATED COST	WORK TO BE PERFORMED	FROM
	<input type="checkbox"/> NO <input type="checkbox"/> APPROVAL <input type="checkbox"/> DISAPPROVAL <input type="checkbox"/> AUTHORITY	<input type="checkbox"/> ENVIRONMENTAL CONSIDERATIONS <input type="checkbox"/> EIS/EIA INITIATED <input type="checkbox"/> EIS/EIA COMPLETED	<input type="checkbox"/> FUNDED <input type="checkbox"/> IN-HOUSE <input type="checkbox"/> SELF-HELP <input type="checkbox"/> CONTRACT <input type="checkbox"/> TROOP <input type="checkbox"/> UNFUNDED TOTAL	<input type="checkbox"/> DIRECT <input type="checkbox"/> AUTOMATIC REIMB. <input type="checkbox"/> FUNDED REIMB.
				DATE
				SIGNATURE
				REMARKS
FORWARD ACTION		APPROVAL ACTION		FORWARDED TO
DOCUMENT NUMBER	SERIAL NUMBER	TYPE	ACTION TAKEN	DATE
15161718	191211222324	MO OA	MO OA	15161718
5161718	191011121314			